Issued Weekly by the

Hill Publishing Company

JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.

505 Pearl St., New York.
6 Bouverie St., London, E. C.
Unter den Linden 71, Berlin.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings: 33 marks: or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Engminjour, N. Y.

CIRCULATION STATEMENT

During 1910 *we printed and circulated* 526,500 *copies of* THE ENGINEERING AND MINING JOURNAL.

Our circulation for October, 1911, *averaged* 9875 *copies per issue.*

November 4..... 10,500
November 11..... 9,300

None sent free regularly, no back numbers. Figures are live, net circulation.

Contents

PAGE

Editorials:
The Alaska Coal Question..... 925
The Ancient Mine as a Source of Profit 926
Cyaniding in Mexico..... 926
Correspondence and Discussion:
Principles of Mine Taxation....
Leaching Copper Sulphide Ores in Place..... 928
Giroux Consolidated..... 929
Compromise in Michigan Iron Land Titles.....*Special Correspondence* 929
Silver in the East..... 929
The Porcupine Camp..... 930
Ray Consolidated Report..... 930
Iron Ore Rates..... 930
Details of Practical Mining:
*Filter for Slime Samples....
Threading Dies for Pipe....*Improved Byrant Crosshead....*Matte Conveyer at Mammoth Smeltery....
A Method of Reconnaissance Surveying....*Cananea Arc Type Gate....
Protecting Tools from Rusting..... 931
The Alaska Coal Question..... 934
The Question of the Public Lands..... 935
The New Tin Contract of the London Metal Exchange..... 936
United States 1910 Pyrite Output..... 937
Oakland City Oilfields, Indiana. *Ralph F. Blatchley* 937
First Aid to Mining Machinery—V. *Henry M. Lane* 938
The Policy of the Steel Corporation. *E. H. Gary* 941
*Chilean Milling in Peru...*B. L. Sackett* 943
A New Electric Steel Process..... 945
*A Method of Underhand Stoping. *George A. Laird* 945
Michigan Mining Accidents..... 946
The Genesis of Ore Deposits—II. *E. K. Soper* 947
Alundum Crucibles..... 949
*Electrolytic Refining of Gold. *Edward B. Durham* 950
*Determination of Meridian. *D. J. Browne* 954
Rhodesian Chromium Ore..... 955
*The Mineral Region of Collahuasi. *Manuel C. Gonzales* 956
San Luis Potosi Salt Industry..... 957
Cyanide Mills in Chihuahua..... 957
Personal, Obituary and Societies..... 958
Editorial Correspondence..... 959
Mining News..... 961
Markets..... 967

Illustrated.

The Engineering and Mining Journal

Vol. 92. NOVEMBER 11, 1911. No. 2

The Alaska Coal Question

At Chicago, on Oct. 27, Secretary Fisher as fully authorized spokesman for the Administration declared its policy with respect to the Alaska coal question. Mr. Fisher, as everyone knows, recently paid a visit to Alaska and consequently his knowledge of conditions there was obtained directly. Of course he could not fail to be impressed by the necessity of making immediately available the coal resources of the Territory if its commercial progress is to be promoted. Everybody recognizes that, except those wild conservationists who think only of posterity. What then is to be the manner of the opening?

There are three possible ways, viz.: (1) Sale of the lands in fee and leaving the development to private enterprise; (2) development by private enterprise under lease from the Government; (3) operation by the Government itself.

The third method we dismiss immediately as abhorrent. The entrance of the Government into commercial operations is the last thing that any sincere exponent of individualism would desire to see. It has been the free play of individualism that has made this country great and we ought not to try any dangerous experiment.

By the same token it may well be urged that the Alaska coal lands would best be given away to individuals. Thus were granted the mineral lands of the West and the policy proved to be wise; witness the phenomenal industrial development of that region. These deposits were often exploited in a bungling and wasteful way, but the times did not permit of refinement. The Government received nothing from them directly, but indirectly the whole people received their share. In the actual location of mineral lands there was ever an open field and never any complaint that rights were unequal.

Some pioneers made locations in the Alaska coalfields in the same way, but were ousted as violators of the law. They did not exercise any rights that were not open to every citizen of Maine, Florida and all of the other States, but they happened to be alert enough to go first to the field and they thought that they were engaged in a commendable enterprise in risking their money in the development of natural resources in a remote wildness. They were confronted by an impracticable law and did not dodge it quite far enough. Their intentions were praiseworthy, rather than the reverse, and we give them our sympathy.

We are bound to admit, however, that the popular sentiment against the giving away of the nation's resources—the policy that worked so well in the past—is now so strong and tenacious that no further exercise of that method is to be expected, at least not in the case of coal lands in Alaska. There remains, therefore, only the granting under lease and that is what Secretary Fisher recommends as a system avoiding the controversies and the difficulties of both extremes of public and of private ownership. This conforms to a recommendation made by President Roosevelt in 1907. We may add also that the leasing system has been adopted successfully by at least one State in the exploitation of its coal lands and there is ample precedent for the Federal Government to appear as a lessor of its mineral lands, the lead lands of the Lousiana purchase having been exploited under that system from 1807 to 1847. The Canadian Government in 1907 adopted this policy in its western provinces.

If Congress be now led to provide a leasing system for Alaska, much will depend upon the terms. These should not impose any limitation as to time, but should provide for a readjustment of royalty at reasonable periods. There should be conferred the right to secure large areas of coal land, as much as 2560 acres in all cases and up to 7680 acres in certain cases, based upon a graduated schedule varying according to the thickness of the coal in the several fields as reported by the U. S. Geological Survey. There should be the minimum of Govern-

mental supervision, except insofar as the safety of employees is concerned. The matter of royalty will be difficult to adjust. It should be reasonable and low, recognizing that the coal will come into competition with California petroleum and will be greatly limited as to market by the latter, but what may be a reasonable royalty at one place in Alaska may be quite unreasonable at another.

The essential thing is to throw the Alaska coal lands open to development and do it quickly. There are some purposes, some branches of smelting, for example for which petroleum cannot be used and for which coal is required. What Alaska needs more than anything else is more railway, but no one is going to put his money into that kind of development, or any other, so long as the resources of the Territory are locked up. The proper policy is to release them and leave all the rest to individual enterprise, which will quickly go ahead if there is any money to be made. If there is not and private capital will not take hold, the Government should not. Any schemes to have the Government buy the Alaskan Central railway, which Secretary Fisher has been told can be acquired at cost and recommends, or the Copper River road, which no doubt could also be acquired at cost, should be promptly turned down. If Alaska be saddled with any loads its future will be dark indeed.

If Congress at its next session finds time to ameliorate the Alaskan situation we hope that it will also remember that the present coal-land laws of the main part of the United States are inadequate and unsatisfactory and that here also large acres have been withdrawn for posterity. We hope that it will enact a new law permitting industrial companies to secure such coal as may be needed and in tracts sufficiently large to conform to the conditions of modern mining without leading anybody into perjury or to incur any risks of indictment by zealous officials. As an illumination of this whole subject and as a guide to Congress, we think that we cannot do better than to reprint an editorial from the JOURNAL of Dec. 21, 1907, which we do elsewhere in this issue. We regard this article, based as it is upon the results of experience, to be one of the most important contributions to the literature of this subject. The whole question is one that should be viewed in the light of common sense.

The Ancient Mine as a Source of Profit

The possession of an *antigua,* or the search for one, forms the basis of many roseate prospector's dreams and prospectuses. The basis of these rests on a contempt for the ancients and an admiration for ourselves, which is not entirely justified. However, in the treatment of complex ores, wherein chemistry and electricity may play a part, the advances have been tremendous, and if the mine was anciently abandoned because of the refractory character of the ore, there is a good chance of success. In smelting operations we are also superior, chiefly through the use of coal and coke and of high-blast pressures.

But in the simple matter of ore extraction, it is to be doubted whether we do much better than the ancients. We have the modern methods of applying power —they had an extremely antiquated, but highly effective method of applying slave labor to the job in hand with highly commendable results, and slave labor could be taken where fuel is still scarce.

On the Veta Madre in Guanajuato, the Valenciana shaft, 30 ft. in diameter, was sunk 1725 ft., by animal and man power only, and might have gone deeper had human labor remained the cheapest of commodities. The scent of the *Conquistadores* for gold, and the ingenuity of their pumping and mining operations can be seen by research in any South American country. How can one compete with ancient superintendents when one can no longer starve laborers to a superlative thinness in order to follow small veins? Nor did great engineers begin with Leonardo da Vinci, nor even with Archimedes. The simplicity and ingenuity of the device by which the Greeks moved their marble columns astonishes us. The Egyptian quarrying operations were conducted with a conservation of natural resources which would be creditable to anyone, and to move one of their monuments is still regarded as a wonderful feat.

Many of the mines of the ancient world are known only because they were accurately described, as only traces of ore remain in them. In general, then, an *antigua* needs careful examination, and a liberal discount made for the effectiveness of slave labor and the skill of its drivers.

Cyaniding in Mexico

A consideration of the many successful cyanide plants in operation in Mexico at present makes it difficult to realize that that country was comparatively late in adopting the cyanide process. The somewhat belated acceptance of cyanidation was probably due in a large measure to the fact that in the early years of the process the extremely weak cyanide solutions, so effective on gold ores, were found unavailing on ores high in silver, and the process consequently condemned as not being suitable for economical treatment of silver ores.

While there was a movable cyanide plant in Sonora as early as 1894, the real pioneer work in the metallurgy of silver-bearing gold ores was done in the district of El Oro. The process used at El Oro was later applied successfully to the ores of Guanajuato which ran higher in silver. The work in these two districts blazed the way for the application of the cyanide process in the Pachuca district.

Having found that the cyanide process was an economical means of treating low-grade silver-gold ores, Mexican operators have shown a remarkable readiness to adopt modern machinery and improved methods when increased efficiency could thereby be gained. As a result, despite the handicap of a late start, Mexico is now in position to speak authoritatively on the subject of silver cyanidation.

The new tin rules of the London Metal Exchange are meeting with some opposition from dealers, as was to be expected. These rules are intended to broaden the market by admitting several brands which are not good delivery under the existing rules; and by so doing to increase the difficulty of making corners in the metal, like that which has disturbed the market for several months past. In this they may help to some degree; though it is to be feared that the possibility of corners will always exist as long as the actual consumption of tin continues so close to the production as to leave no appreciable margin.

A large amount of silver, held in London for months past on China account, has been shipped to the East during the last week or so, doubtless to stiffen silver reserves in China where the unrest has caused a good deal of silver to be hoarded.

By The Way

The analyses for impurities in two bronze axes found in Tuscany are given in Mosso's "Dawn of Mediterranean Civilization" as follows: No. 1, Sn, 8.29 per cent.; Pb, 0.204; Bi, tr; Zn, 1.6; Fe, 0.14; As, 0.009; S, 0.068; No. 2, Sn, 6.954, Pb, 4.346; Bi, 0.108; Zn, 2.08; Fe, 0.49; As, 0.004; S, 0.123 per cent.

Pressure at depth is shown in a peculiar manner in the levels of some of the copper mines of upper Michigan. The hanging-wall side of the floor of some of the deep drifts in a mine on the Osceola lode is forced upward to such an extent that it is necessary to clean out that side of the level from time to time in order to keep the tracks in proper condition. One's first thought is that the hanging-wall side would be depressed and the foot-wall side raised.

Perhaps in no line of investment does the average investor exhibit less caution than in mining. Even laymen who have friends among mining engineers often shun them until after they have made their investment. They blindly plunge in, and then when the promoter's promises fail to materialize and the money is all spent, they may venture to mention the matter to a mining engineer. At this stage, however, it is usually a post-mortem affair and if the engineer does succeed in wrestling the job from the coroner, the investor has had so narrow an escape or is so maimed financially that he can no longer be counted upon for mining investment. *Life* in its superior wisdom sums up the matter in the following conversation: "How did he make all his money; by careful investment?" "No, careless investors."

Discussing the action brought by the Government against the United States Steel Corporation, Governor Baldwin, of Connecticut, is quoted as saying that "It will raise an interesting question as to whether the Government ought in good faith to go behind the assurance the company has received from President Roosevelt that he should not deem it his duty to have it prosecuted under the Sherman act. This it doubtless understood to be morally binding upon the United States and not simply upon President Roosevelt. The pith of the Government's contention is that the officers of the Steel company misled the President by a statement of fact. This will apparently raise an issue of fact between the parties to that conference at Washington in which immunity was sought and, as the company supposed, obtained."

That Germany is not without its benevolent trusts is shown by a recent report from Consul Talbot J. Albert, of Brunswick. "Phonolith is a new mineral fertilizer, as it is free from chlorine and contains 10 per cent. of potash, it has become a competitor of the fertilizing salts produced by the syndicate. The competition has become so serious that the syndicate has sent a circular to all the dealers in phonolith that no more potash salt will be delivered to them unless they cease from selling the competing fertilizer, and unless they obligate themselves under a penalty of 100 marks not to deal in phonolith again. . . . .Since the above report was written, the potash syndicate has published a statement claiming that their action is in the interest of honest trade and should be approved, since the price of phonolith does not correspond to its worth as a fertilizer and to the advertising concerning its merits."

The *Evening Post* remarks that one secret of Mr. Hill's hold upon his following of investors and speculators, whose patience and fortitude are widely known, is that he has the rare faculty of doing up an astonishing amount of wisdom and prophecy in one catching phrase. It is a faculty much more rare among financial leaders than among political leaders. Of the proposed cancelation of the famous United States Steel-Great Northern ore contract, Mr. Hill says: "Iron ore does not go out of style, and it will not run away." Every holder of Great Northern Ore certificates will quote that until his certificates are worth $200 or $300 apiece, or as much as Mr. Hill says they ought to be worth. Brokers will quote it when clients ask them what they shall do with their ore certificates. And any steel manufacturer, independent or other, will have to climb over it to make a bargain in the future for Great Northern ore.

One of the promoters' magazines is going in for "higher education" of the investor. It is publishing in all seriousness, apparently, a mining glossary, from which we quote the following: "*Adit,* a tunnel into a hill; *artesian wells,* holes bored through solid strata, and often overflow; *bituminous,* carrying mineral pitch; *cleavage,* the property of splitting in one direction; *dyke,* any ingenious (*sic*) rock which has filled a fissure in a straight line and stands above the level; *freestone,* sandstone easily dressed; *grassroots,* the surface above a mine; *jamb,* any thick rock which cuts off the vein; *kies,* the sulphides separated from the rock matter; *lead,* a dry river bed yielding ore; *massive,* not stratified, without cleavage; *muffle,* an oxidizing furnace; *placers,* gravel diggings on bed rock; *sampling works,* small plants for testing ores on a working scale; *sulphureous,* the odor of burning sulphur; *synclinical,* the trough formed by the downward inclination of the strata from each side, the anticlinical being the ridge when the strata dips in opposite directions; *tallings,* the waste material from a mill; *tunnel,* a level into a hill." Shake well before using.

The following opinion from a New York commercial house is clear and logical: "Neither the President of the United States nor his Attorney-General is the Government. On questions of law, as to the reasonableness or unreasonableness of any combination of capital, the United States Supreme Court is the final authority. That court holds that the Sherman law must be construed in the light of reason. The United States Steel Corporation is of all the great corporations in this country the most reasonable. So far as a layman can see (and when eminent lawyers and the President and Attorney-General disagree a layman's opinion is worth something) the suit is not justified by the decisions in the Standard Oil and Tobacco cases. These corporations had notoriously been guilty of unethical acts to crush competition. The United States Steel Corporation has always been tolerant of competition. It has encouraged competition. It has avowed and pursued a policy of live and let live in trade, and the remarkable result is that at the present time all of the big independent steel companies, instead of being against the big company, side with it."

The attitude of the Kafir on the subject of strikes is becoming one of no little interest. That he is not unfamiliar with them is shown in the annual report of the Government Native Labor Bureau last year. The *South African Mining Journal* records that in April, about 200 British Nyasaland natives struck work at the Simmer Deep, owing to the arrest for assault of one of their number, whose release they demanded. Fifty-seven of these natives, who would not listen to reason, were each fined 5s. for refusing to work. The fines were advanced by the company and the natives resumed work. In August, 107 natives employed at the Simmer & Jack East refused to work. Their complaint was frivolous, and as they refused to return to work they were charged before the magistrate, at Germiston, by whom they were convicted. On Aug. 11, upward of 500 natives employed by the Rooiberg Minerals and Development Company refused to work, as the result of an assault committed on one of their number by a European miner. Although every assurance was given them, they refused to resume their labor until the police appeared on the scene. In September, a number of British Nyasaland natives employed at the Cason, Driefontein, Cinderella and New Modderfontein gold mines refused to work. The fullest inquiry was made into their grievances, but eventually 360 were charged before the magistrate at Boksburg and were convicted. There is little doubt that the whole movement was engineered by agitators. Nevertheless, the possibilities of native combination in this direction are not wholly negligible.

Correspondence and Discussion

Principles of Mine Taxation

In the JOURNAL of Oct. 28, Edmund B. Kirby mentions taxing mineral lands at their "true cash value," and refers to Mr. Finlay's decision in making his report on the Michigan copper and iron mines that he could find no basis to arrive at a value for such lands. It is certain that a State should use the same methods for arriving at the value of a mine as used by private corporations. If this be true, one must admit that the "true cash value" of a mine is the present worth of its annual dividends, and if the beginning of the dividend period is a number of years ahead, this present value of the dividends must be deferred a like number of years. Therefore, if this rule is applied, how can one arrive at the true cash value of an unprofitable mine, when it is admitted that it has no value as a mine, by using the only sane method of appraising its value?

In the case of mineral lands and rights, if they are appraised on the same basis—and they must, if their mineral contents are considered—how can this rule be applied when every factor is unknown? for the problem to be solved is as follows: What is the present value of an x annual dividend for y years deferred z years. The last factor may be one or 100 years, depending upon some interested party having faith enough to undertake the development, which may never occur, and in the event development was started the first two factors are still to be determined only by experience, with a percentage in favor of proving conclusively that it has no value as a mine.

To me there seems to be but one opinion that can be arrived at after careful study of the taxation of mining properties; i.e., that a mine has two values, one represented by its surface rights, to be appraised as any other real estate in the vicinity, and the other the value of any orebodies demonstrated profitable by mining operations.

A State can no more afford to undertake to place a true cash value upon an unproven tract of mineral land than an engineer for a private concern. The State is entitled to assess a property for every dollar it is worth, but should not create value where it is not known to exist; it must use business methods in dealing with fixing values. The mere fact that a certain price is asked for a tract of land does not establish its true cash value; neither does an occasional sale at high prices demonstrate that the land is actually worth the money paid for it. If we were to use this rule, we would be compelled to establish the value of a mine by the prevailing stock quotations, to the absurdity of which any engineer will testify. Mr. Finlay brings out this point in his report, and as his work was to appraise the value of mines, he made no attempt at placing a value upon the real estate of the mining districts and mineral zones, but left this to the local appraisers.

HEATH STEELE.

New York, Nov. 2, 1911.

Views, Suggestions and Experiences of Readers

Leaching Copper Sulphide Ores in Place

The extraction of copper from its ores *in situ* has recently been discussed in the JOURNAL, in articles that showed that the process, while limited in its application, has been used for many years.

Nature is continually occupied in leaching ores, in place, precipitating the metals elsewhere and leaving behind tailings, often valueless, such as gossans, etc. The efficiency of any commercial work has to be measured in money, and a high recovery is not necessarily evidence of good work.

Much experimental work has been done in extracting copper from crushed sulphide ores, sometimes employing as solvents synthetic solutions in imitation of those formed naturally which remove copper from the higher zones and redeposit it lower down, forming the zones of secondary enrichment.

It is not without interest to call to mind the operations at Rio Tinto and also the analogous case at Goslar in the Hartz, where for centuries zinc sulphate has been produced directly from complex sulphide ores by heap leaching. There are few published records showing that unoxidized copper ores are actually leached in place on a working scale, but such is actually the case, and the fact is that it has been carried on day in and day out for over 60 years at a mine barely 300 miles from London.

The history of the mine in question is lost in antiquity. There is evidence that in places the vein was more than 100 ft. wide, but in many places the width was so small as to render it unprofitable. In the past the system of mining was such as to convert practically the whole of the underground workings into what resembles a huge rabbitt warren. The copper lode is associated with other lodes of a complex nature and this in conjunction with the fact that the whole of the underground workings are thoroughly honeycombed, is doubtless, to a large extent responsible for the ease and rapidity with which so much of the copper passes into condition of sulphate.

The mine is drained by an adit, the mouth of which is dammed and fitted with a sluice valve. The mine is then pumped full of water, practically to the collar of the old main shaft. As soon as this is done the valve at the adit mouth is opened and the copper-bearing water runs to the precipitating plant, which consists of a number of shallow, rough, stone-lined pits, arranged in parallel series for convenience in cleaning and distributing solution. These pits are filled with scrap iron.

After the deposition of the copper the solution containing not only the iron derived from the ore, but also that from the precipitation pits, which has replaced the copper in the solution, flows through a number of pits similar to those used for precipitation, but larger. These pits are also arranged in parallel series. Here the solution, by oxidation and aëration, deposits the bulk of its iron as good marketable ocher, which, according to the quality and the market, is worth from 20s. to 30s. per ton.

The water, now more or less free from iron, is, when required, pumped back to the mine, to go through the same cycle of operations. The solution flows by gravity from the adit mouth through the precipitation pits, and thence through the ocher ponds, power being used only for pumping the water back to the mine when required. The mine is filled with water from two to four times per annum, varying with the seasons; only one skilled man is employed with two or three laborers, these latter being increased at such times as ocher or copper precipitate is being cleaned up.

The contour of the country, the system, or rather lack of system, in mining in the past, the fact that much ore had been left in place either on account of width or grade or both, and the existence of large blocks of a complex sulphide ore containing small quantities of copper, these facts taken together have made it possible, in this case, to leach copper sulphide ore in place.

The net result is, and has been since the inception of this method of treatment, about 200 tons of metallic copper per year, and from 1500 to 2000 tons of ocher during the same period. The whole equipment is one which, when seen, demands admiration, if only on account of the ingenuity which has secured good working results from a layout which, without any slight, may be called crude.

H. T. DURANT.

London, Oct. 25, 1911.

Giroux Consolidated

Thomas F. Cole, James A. Snedaker, consulting engineer, and Joseph B. Cotton, of the Giroux Consolidated Mines Company, spent some time recently at the mines of the company at Ely, Nev., making a careful inspection of the property and mapping out plans for future development. President Cole said:

"The plans for immediate development and equipment include a concentrator of 1000 tons capacity per day, the building of a railroad from the Bunker Hill shaft to connect with the mill, the equipment of the Bunker Hill shaft and the stripping of the sulphide zone where it outcrops near the surface. Plans are already being drawn to increase the capacity of the present concentrator to 1000 tons capacity. It is expected that all of the plans for the new plant will have been worked out within 30 days from the present time when actual construction will be commenced. The work of connecting the Bunker Hill shaft by railroad with the concentrator will be commenced within a few days, and will be pushed rapidly to completion. The road will be about 1½ miles in length and will parallel the line of the Nevada Northern railroad from the shaft to the crest of the divide between Kimberly and the Veteran mine, from which point it will be deflected to the concentrator.

"Two churn drills will be put to work immediately in the demonstration of the extensions of orebodies. One will be in operation to the south and west of the Liberty pit of the Nevada Consolidated, which is now removing overburden from the Giroux ground in order to open up its orebodies in its own territory. The other drill will be employed in proving the extensions of the sulphide zone on the Morris. For the present the tonnage will be drawn from the Old Glory, Morris No. 2, Brooks and Bunker Hill workings, but no time will be lost in stripping large bodies of sulphide deposits which rise near to the surface of the ground. It is not expected that these extensive deposits will be worked by steam shovels, but after the waste has been removed the ore can be shot down in immense bodies and then hoisted and sent to the mill direct without sorting. The ore will be caved from the lower levels of the present workings of the property and hoisted through the shaft at a small cost for operation.

"The management, after careful investigation, has become satisfied that an ample supply of water can be had from the Giroux shaft to operate the entire concentrating plant, but in addition to this supply the water in other shafts along the sulphide zone could be utilized if necessary. The plans as outlined call for the immediate employment of a large number of men in surface construction, which will probably not be diminished in numbers after the plant is completed and in operation. It means that several hundred men will find employment at the mines of the Giroux company during the winter months. The supply of concentrating ore already blocked out and demonstrated in the underground workings on the sulphide zone is amply sufficient to keep the proposed plant in steady operation for many years to come and in the meantime new orebodies of the same nature will be developed in various sections of the company's vast mineral estate."

Joseph B. Cotton, vice-president, stated that "the work of retimbering the Morris No. 2 shaft is already in progress, and will be rushed rapidly as it will be made the main working shaft, from which ores will be drawn for the mill supply. The shaft has three compartments, and is sunk in solid limestone. It has a depth of about 500 ft. at present, and is connected by drifts with other shafts along the sulphide zone. It will be equipped with the first-motion hoisting plant now in operation at the Giroux shaft, which will soon give place to the new and larger engines. The foundation for the engine and the new engine house for the Morris will be under construction within a few days."

Compromise in Michigan Iron Land Titles

SPECIAL CORRESPONDENCE

An important compromise has been effected among the several claimants to about 100 acres of iron-ore land lying in the southeastern outskirts of the city of Negaunee. The Cleveland-Cliffs Iron Company, the Breitung-Kaufman mining interests, the Mitchell estate and several of the original owners of the property were involved in litigation over conflicting and overlapping titles, questions on which ran back to the pioneer days of the district in 1850. It has been agreed to develop and mine on the land through two mining companies to be known as the Lucky Star Mining Company and the Bunker Hill Mining Company, stock in which will be held by the different claimants in the same proportion as their interests in the lands. Under the new arrangement the Lucky Star Mining Company has title to 50 acres of land contiguous to and west of the Steel Corporation's Prince of Wales mine; four diamond-drill holes have indicated about 5,000,000 tons of soft ore lying between depths of 900 and 1300 ft. The Bunker Hill Mining Company has title to 50 acres of land just south of the Breitung Hematite mine, which is of known mineral worth. The Cleveland-Cliffs Iron Company and the Breitung-Kaufman mining interests will get the greater part of the stock in the two new companies. The Breitung-Kaufman interests are operating three mines in the immediate vicinity, the Breitung Hematite, Mary Charlotte and Milwaukee-Davis mines, and have been heavy producers during the last season.

Silver in the East

Under date of Oct. 19 Messrs. Samuel Montagu & Co., of London, comment as follows on the prospects of the silver market in the Far East. The causes to which they refer have since led to a sharp advance in prices.

CHINESE DEMAND

The revolt in China appears to be gaining headway; its widespread character, and the sympathy of a portion of the army render the task of the central government more difficult than on previous occasions when insurrections, ill organized, often ignorantly led, and counter to the interests of foreigners, have had to be dealt with. It is, therefore, of moment to consider the bearing which a prolonged conflict may have on the future of silver.

The initial effect of the outbreak was to produce a crop of selling orders on China account for forward delivery—possibly to square some exchange operations—but it does not follow that disturbances spun out over a long period will continue to depress the price and that for the following reasons:

As far as can be ascertained, the rebellion is not of a predatory character. Military operations will be confined as far as possible to the obtaining and retention of civil authority, and will thus be waged over the heads, as it were, of the common people. Sowing and reaping throughout the great area of China will proceed as usual except in the immediate vicinity of military operations; thus it is probable that ordinary imports will suffer rather than exports; should this be so, silver would benefit. In the event of the struggle becoming one of the first magnitude, there will probably be a tendency to hoard silver until the calamity be overpast. At the same time, the maintenance of military operations will necessitate the use of a large amount of currency. Finally, the strain of carrying on war may be too onerous for Imperial finance without recourse to loans. On the other hand, a falling away of ordinary imports may be set off by the munitions of war which the Chinese Government may find it necessary to acquire, and no strenuous contest can take place without great disturbance of trade in the water-shed of the Yang-tsze-Kiang.

PROBABLE COURSE IN INDIA

The sales of silver on China account, to which we have refefred above, had surprisingly little effect on the price owing to a very active inquiry from the Indian Bazaars for prompt shipment. The

strength of this inquiry lies in the anticipation of Indian government purchases becoming necessary at a not distant date. In recent times the withdrawals of silver rupees from the Indian Treasury between the month of October and the late spring of the following year have been at least 10 crores, so that allowing for a transfer of the 3 crores still earmarked to the gold standard reserve, the total next spring might fall to about 17 crores. Unless the government proposes to take some step toward establishing a gold standard, so much desired in certain native circles, we may find the Indian government in the market before the treasury is depleted of silver coin to the extent above mentioned.

It may be argued that owing to partial drought this year, the outgoings will not be up to the mark of the withdrawals in the same period of the years immediately preceding; but it must be noted that the rice crop, especially the important one of Burma, is considered very good, and its value is likely to be enhanced in consequence of the high prices following the failure of the crop in China through disastrous floods.

The Porcupine Camp

SPECIAL CORRESPONDENCE

The twentieth annual report of the Ontario Bureau of Mines shows that for the year 1910, nine Ontario mines produced gold amounting to $68,498; of these only two Porcupine properties, the Dome and the Hollinger, are credited with any output. While the amount was small there has, during the last year, been a great impetus given to gold mining throughout the province, and that branch of the industry is coming out of the cloud under which it has rested so long. Had it not been for the Porcupine fire in July, the production for 1911 might have shown a material increase, but operations have been delayed to such an extent that none of the mills will now be running before next year. It is, however, fairly safe to predict that during 1912 Ontario's gold output will increase considerably.

Development of the Porcupine area, has stimulated interest in every part of the province, and many sections are again coming in for public attention. Two years ago it would have been almost impossible to raise the money to finance a gold enterprise in Ontario, but since the development of some of the Porcupine properties, it has been much easier. Indirectly Porcupine owes much to Cobalt, for many fortunes were made there from small beginnings, and a considerable portion of this money is going into the gold district. On the other hand, the successes made in Cobalt are apt to have a bad effect on Porcupine; many investors do not realize that placing a low-grade gold mine on a producing basis is quite different from the bonanza mining in Cobalt where shipping ore was encountered from the grass roots.

To date over 75 Porcupine mining companies have been incorporated, and it is safe to say that the majority of these will be failures. Some, of course, are doomed from their inception, others are working veins that will not pay under existing conditions, while many will not have sufficient funds to carry on the work. Once a property is acquired, it will probably require a minimum of $250,000 to place it on a producing and self-sustaining basis. The necessity for caution is evident, but the possibilities are also great. Several of the Porcupine mines have a bright outlook, while two or more have an assured future. The possibilities of the district are by no means exhausted.

Ray Consolidated Report

Under date of Oct. 25, 1911, the Ray Consolidated Copper Company has issued an interim report of the progress made at its properties near Kelvin and Hayden, Ariz. The company announces that quarterly reports will be hereafter issued.

About May 1, the No. 1 shaft equipment was completed and is now in operation. The equipment at No. 2 shaft, now completed and ready for operation, is similar to that of No. 1 shaft but the capacity of the crushers is only 200 or 300 tons, or about half as great. All the shops, warehouses and accommodations for employees, that are immediately necessary, have been completed.

READY TO STOPE 3,000,000 TONS

The eastern section of the mine is adjacent to No. 1 shaft, and there is 3,000,000 tons of ore ready for stoping in the ground now developed. In the western section of the mine, served by No. 2 shaft, the No. 1 level has been completed to the western limits of the developed orebody, a distance of 4300 ft. The shaft and stations are completed to the second level, 165 ft. below the No. 1 level. The second level is being opened from two faces and will be completed to the western limits of the developed orebody, some time in December. Most of the ore so far mined has been taken from the ground adjacent to the No. 1 shaft. Some stoping has been done above the No. 1 level of the No. 2 shaft, but the tonnage raised through that shaft will not equal that raised through the No. 1 shaft, until the second level is completed.

Stoping has been done in the eastern section on a large scale, for about five months, and in the western section on a small scale for about two months. During September the cost of stoping averaged about 65c. per ton, which amount included a part of the current development cost, crushing and delivering the ore on board cars ready for shipment to the mill.

The ore is now being mined from the upper zones of the deposit, and is a little lower in grade than the general average. To date the average copper content of all ore mined has averaged slightly less than 2 per cent.; and at present about 1.85 per cent. When the entire mill is ready for full-capacity operations it is expected that the grade of ore can be maintained at an average copper content of 2.17 per cent.

FOUR UNITS OF MILL IN OPERATION

The concentrating mill is built in eight sections, four of which are in operation. The fifth is now being completed and all machinery for the other three is on hand. In each section there is now being treated more than 800 tons of ore; they were designed for treating 1000 tons and it is expected that it will be possible to attain that capacity without difficulty.

The production to Oct. 1 totaled 9,000,000 lb. of copper; at present 2,500,000 lb. are being produced monthly, and by the end of the year the production will be nearly 3,000,000 lb. The recovery is about 69 per cent.

The American Smelting and Refining Company purchased, at cost, the smeltery of the Ray company, in process of erection, and will smelt the concentrates from the mill. Shipments to this plant will begin after Jan. 1, and the full output be received after April 1. The smeltery will be completed some time in 1912. At present the concentrates are being shipped to El Paso, which is stated to add 1½c. per lb. to the cost of producing copper, in greater freight and treatment charges.

No additional equipment has been purchased for the Ray & Gila Valley railroad, in operation between Ray Junction and Ray. The ore is being transported by 100 cars, which number will be sufficient until a capacity of 4000 tons per day is reached.

Iron Ore Rates

The reduction of the ore freight rates on the Steel Corporation's two railroads, the Duluth, Missabe & Northern, and the Duluth & Iron Range, from 80c., 90c. and $1 per ton, to a flat rate of 60c. per ton, for distances averaging about 90 miles, places the Minnesota ranges more on a par with the proportionate rates paid on the Michigan ranges where the price is 25c. and 40c. per ton for distances varying from 12 to 80 miles.

The Secretary of the Interior on Nov. 3 announced the appointment of Waldemar Lindgren as chief geologist of the U. S. Geological Survey, to succeed C. W. Hayes, resigned.

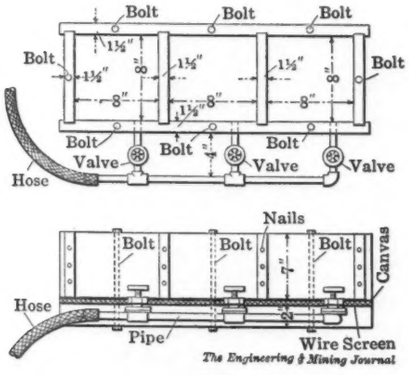
Details of Practical Mining

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent to telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of a pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

Notes of Interest to Prospectors and Operators of Small as well as Large Mines Things that have to be done in Everyday Mining

Filter for Slime Samples

At the cyanide plant of the Tonopah-Belmont company a convenient box for filtering the mill samples is provided. As shown in the accompanying sketch, the apparatus consists of a filter box made of 1½-in. timber, having three filter compartments. The top part, which is 7 in. deep, is bolted to the vacuum box underneath, which is 2 in. deep and also divided into three compartments. Over the vacuum box is stretched a coarse wire screen to support a sheet of 10-oz. canvas through which the solution is filtered. Each compartment is equipped with a valve so that it can be run separately. The box is connected by a hose to the vacuum pipe of the large filter.



TONOPAH-BELMONT SAMPLE FILTER

The samples to be filtered are poured into the different compartments of the box and connection made with the vacuum pipe. When the sample has been sucked dry, the pulp is sampled and the smaller sample taken to the assay office. The pulp remaining on the filters is removed by dumping the box over the main filter tank of the plant.

As there is little danger of salting the mill samples, no great care is taken in scraping the pulp off the canvas. When the canvas becomes worn or clogged it is easily replaced after unscrewing the nuts from the bolts and lifting off the top frame. At the Desert mill similar filter boxes but with one compartment each are used for the same purpose.

Threading Dies for Pipe

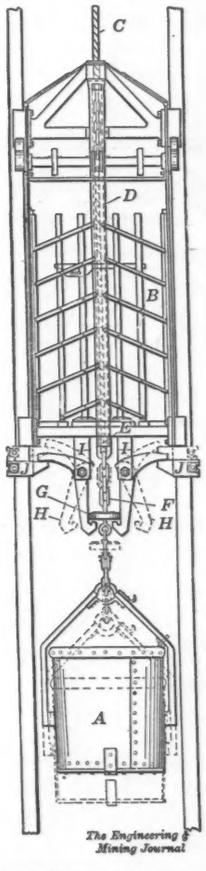
The practically universal use of pipe in mines and mills, where the cutting of threads is conducted mainly by hand and is almost a daily operation, involves some interest in the question of threading dies. The greatest difficulty in threading pipe often lies in the use of dies which are inadequate to perform the duties expected of them. The experience of pipe manufacturers and others who do their threading by machinery indicates that with the use of an improved form of die, mild-steel pipe can be threaded as rapidly as the wrought-iron pipe in common use years ago. The selection of the die, consisting of the frame or holder and a set of chasers, should be made with proper consideration for the following points: Lip, chip space, clearance, lead and a sufficient number of chasers. A recent bulletin of the National Tube Company gives some suggestions on these points.

The old-style lips or rakes with square cutting edges pushed the metal off, leaving a ragged, torn thread and causing excessive friction and labor. This is now avoided in the best makes of dies. The lead or angle on the front of each chaser to enable the die to start on the pipe and also to distribute the work of making the first cut over a number of threads is now usually ground on after the chasers are tempered and a lip angle of 15 to 25 deg. is used, depending on the style and condition of the chasers and chaser holder.

The proper amount of lead is about three threads. When regrinding a chaser that has become dull, care should be taken to give each chaser the same length of lead in order to distribute the work evenly. To get good results in threading at one cut, a die should have a suitable number of chasers, experience indicating that those up to 1¼ in. in size should have four chasers; between 1¼ and 4 in. there should be approximately six chasers; from 4 to 7 in. there should be eight chasers. Good lard or crude cottonseed oil is recommended for threading purposes, as the best die will not produce good results with poor oil.

Improved Bryant Crosshead

The Bryant safety crosshead was described in the JOURNAL of April 15, 1911. The improvement shown in the accompanying illustration consists in a safety device for preventing the falling of the bucket in case of the breaking of the hoisting rope.



DEVICE FOR LOWERING BUCKET INDEPENDENTLY OF CAGE

In the illustration the bucket *A* is shown suspended below the cage *B* by the hoisting rope *C* which passes through a hollow shaft *D* set vertically in the cage. The end of the hoisting rope terminates in a shackle with collar *E*, the collar of which engages and holds the bottom of the cage so as to carry the

cage; the point of support being at the bottom instead of the rope being attached at the top.

A chain *F* is suspended from the hoisting-rope shackle, which carries the bucket as shown. This chain carries a circular disk *G*, which is dished so that the edge fits into and engages the hooked ends of the two bell-crank levers *H* which are pivotally supported from the lugs *I* dependent from the bottom of the cage.

To any part of the guides, at a point below which it is not desired that the cage should pass but below which the bucket is to be used, two lugs *J* are bolted. These engage the ends of the bell-crank levers, *H* throwing their other ends out of engagement with the disk *G*. These lugs hold the cage from sinking but the bucket may be lowered, the hoisting rope passing freely through the hollow vertical shaft in the cage. The hooks and disk provide safety inasmuch as the bucket will not drop from the bottom of the cage in event of the breaking of the hoisting rope.

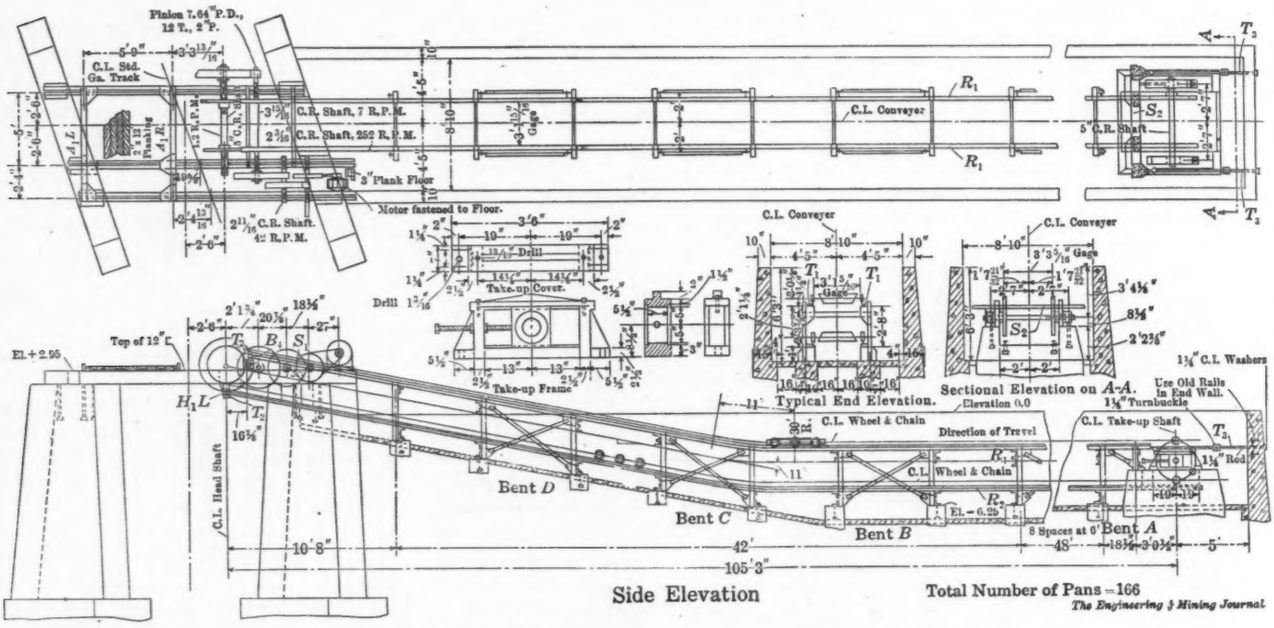
When the cage is resting on the guide lugs, and the bucket is being lowered, the safety dogs at the top of the cage are released so as to bite into the wooden guides so that, in case the lugs should break, the cage will not fall.

In hoisting the bucket the rope passes freely through the hollow shaft in the cage until the disk is at a point above the hooks of the levers *H*. When the collar *E* comes in contact with the bottom of the cage, the safety dogs are released and the cage raised together with the bucket whereupon the bell crank levers drop into position so as to engage the disk. The device is patented.

Matte Conveyer at Mammoth Smeltery

The accompanying drawings show the details of the take-up frame and the method of driving the casting conveyer which is used in casting the low-grade matte for resmelting at the Mammoth smeltery of the United States Smelting, Refining and Mining Company, at Kennett, Cal.

The method of anchoring the take-up device in the pit is to be noted, as considerable trouble was experienced at first in securing the frame in the pit. The driving gear is driven on to the main shaft and shearing pins are used in it, so as to save the device from serious injury in case something catches or breaks. The utility of these shearing pins has been demonstrated during the operation of the machine, they are readily replaceable and the structure carrying the gear wheels is substantially made to take the strain when any obstacle prevents the moving of the conveyer, resulting in the breaking of the pins.



DETAILS OF CONVEYER FROM MATTE-CASTING MACHINE

A Method of Reconnaissance Surveying

The method of making reconnaisance surveys herein described has been used for a number of years by a mining engineer who has been employed in examining small mines and prospects in Central America.

There are few mines near the railroads; a journey of two or three days or more may be necessary to reach them, and often the roads over which one must travel on mule back, have never been surveyed. The question as to whether the mine can be profitably worked is often dependent upon the transportation problem, or the possibility of developing power from the nearby water courses. A map of the roads showing in a rough way the topography of the immediately adjacent country is of considerable advantage when such questions have to be considered.

The method that has been used for such reconnaissance surveying is essentially that used by military men. The data for a map are collected as the party travels over the road. The distances are measured by time, the bearings by compass. Starting from a given point the compass man reads the bearing to a certain conspicuous point on the road ahead; the timekeeper notes the time of starting for and arrival at that point, which gives, approximately, the distance. Arriving at that point, another in the road ahead is selected, its bearing from the first observed, and the time taken to reach it recorded. In such manner the bearings and distances of successive points on the road are determined and from the data a map is plotted.

Allowances must be made for the different gaits of the mules, which will vary from 10 to 80 minutes to traverse a mile—horizontally. To make these allowances, some experience is necessary. In starting out, the mule is "standardized" by taking the time required to walk a measured distance on a level road. Such tests are made several times throughout the day in order that allowances can be made for the slower gait of the animal as he becomes fatigued. It is also necessary to allow a different gait in going up and down hills which will in turn vary

with the length of the hill and condition and tortuousness of the road. On a level road a mule will average better than 350 ft. per min., four miles per hour, or a 15-min. gait; on steep, rough hills it may make only 66 ft. horizontally per min., or an 80-min. gait. In time the observer becomes experienced in making allowances for gait and greater accuracy is possible.

In keeping notes, the left-hand page of the note book is ruled vertically for: Course, bearing, time of starting, time of arrival, elapsed time, gait factor (indicated by the time required to traverse one mile), and calculated equivalent horizontal distance. On the right-hand page the note-book keeper writes notes and makes sketches to indicate the topography to each side of the road, the rocks out cropping, their strike, dip and character, the rivers and streams crossed and any other features that may be desirable.

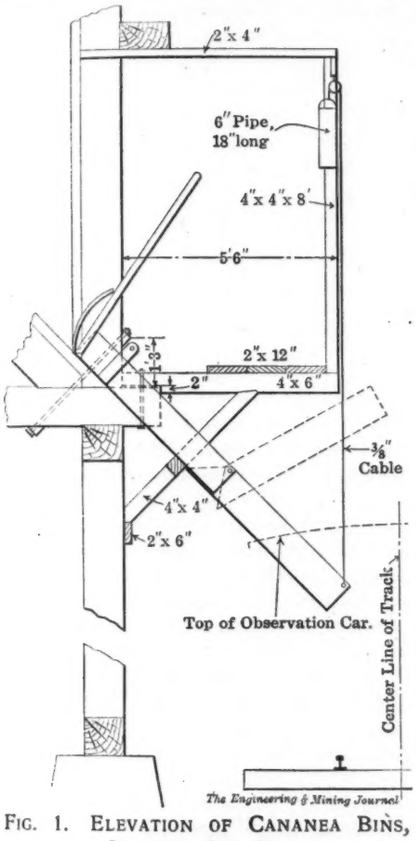


FIG. 1. ELEVATION OF CANANEA BINS, SHOWING ARC GATE

It is advisable to make frequent observations by aneroid to determine the relative elevations along the road as profiles of at least certain portions of the maps may be wanted. The plotting of the maps is done each night when stopping in some town and the topographical notations are sketched in from the notes while the day's journey is still fresh in mind.

While these maps are far from accurate they are often most useful for making tentative plans that will eventually be based upon accurate surveys made by the usual methods. The plotting of the outcrops often gives an excellent idea of the formation of the region, and, above all else, the engineer becomes familiar with the country far more quickly than would otherwise be the case. Of course, such work delays traveling but the delay is negligible when the value of such records is considered.

As for accuracy, the engineer who has so extensively used this system in Central America has stated that, with a squad of men having had a little experience, two such surveys, over different roads, each about 80 miles long, measured in a roughly circular course, have checked within a mile. Such checking may seem absurd to surveyors but for the purpose of such work an error of one in 80 is accurate enough.

Cananea Arc Type Gate

The arc-type gate shown in the accompanying illustrations is used in the ore-bin chutes at the mines at Cananea, Mexico. It may also be modified for use in underground chutes. The novel feature of the gate is the axle which is made of round iron bent as shown in the lower part of Fig. 2. The center of the rod, of which the axle is made, is flattened and bolted to the sheet forming the door.

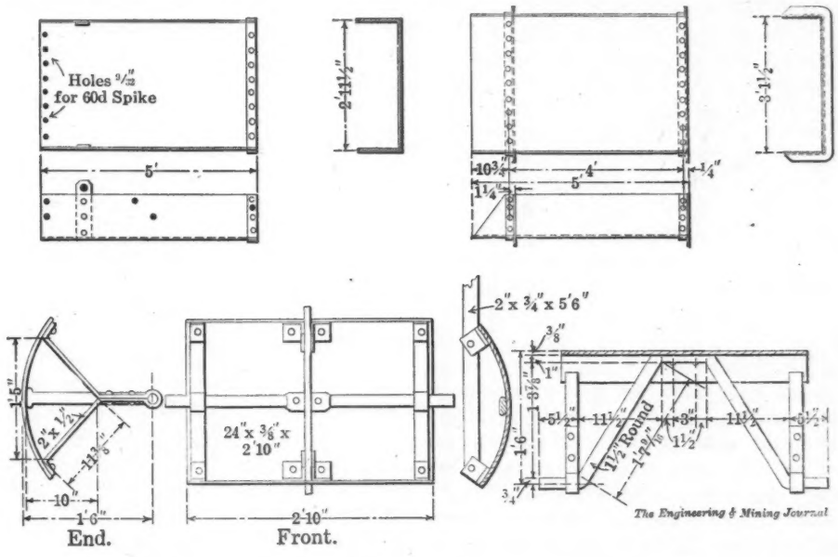


FIG. 2. DETAILS OF METAL PART OF ARC-TYPE GATE FOR CHUTES

The position of the gate in the ore bin is shown in Fig. 1, in which illustration is also shown the manner of building the steel chute, below the gate, so that there is a hinged lower portion which is counterbalanced by a weight permitting the swinging of that portion of the chute up out of the way of passing trains the tops of which are higher than the tops of the cars used for ore.

The details of the steel chute are shown in the upper part of Fig. 2. A runway is built in front of the bins to give easy access to the handles operating the gates and so that the operator can take a position above the top of the car he is loading.

Protecting Tools from Rusting

When steel tools are being constantly used there is, with ordinary care, little danger of annoyance from rusting, but when tools are used only at infrequent intervals, or are put away in cases, rusting is apt to take place even in a room that seems free from moisture.

A light superficial rusting does not injure the tool, such coatings can be easily removed and only the appearance of the tool will be affected. But if left for a long time, serious pitting will result which nothing but turning off the affected metal, in a lathe, will remove.

The supply of reserve tools, stored in the warehouse to replace lost and worn-out tools, should, upon being received, be coated with some dressing that will protect them from rust. Before applying such mixtures the surfaces of the tool should be thoroughly dried so as to permit the dressing to come in contact with the steel and to eliminate moisture that might be held between the surface and the protective coating.

To keep tools clean and bright, rub a little mercurial ointment over them, which will form a moisture-resisting coating. Another good mixture to keep tools from rusting is made by taking six parts of lard and one part of rosin. Heat these together slowly till the rosin is melted. The mixture had better then be taken out into the open air for fear of fire, and benzine added in about the proportion of one pint of benzine to ½ lb. of lard-rosin mixture. When cool the mixture can be rubbed lightly over the bright steel articles. Tools thus treated will resist the corrosive action of salt water.

The Alaska Coal Question

Secretary Fisher advocates leasing system for opening the Alaskan coalfields. Extent and value of coal have been much exaggerated. Development hindered by inadequate transportation and laws.

At the meeting of the American Mining Congress on Oct. 27, Walter L. Fisher, Secretary of the Interior, who recently made an extended trip through Alaska, delivered an address on "Alaskan Problems," in which he gave some of the conclusions drawn from his observations. He said in part:

"At the very outset I wish to express the high opinion I formed of the remarkably large and fine body of people who have become permanent residents of Alaska. The total population is about 65,000, of which a little less than half are whites.

Great Possibilities of Country

"I found Alaska a country of great mineral and agricultural possibilites. Indeed I should go further and say a country of great mineral and agricultural probabilities needing development, ready for development and inviting development but held back chiefly by inadequate transportation facilities and inadequate laws.

"Its present steamship lines are probably as good as could be expected. Its present railroads are incidents to the exploitation of its mineral resources. I am convinced that the coal withdrawals have exerted only an incidental influence upon the development of railroads in Alaska. If the coalfields had remained open to unrestricted private exploitation, railroad development might have been stimulated, but in that event the profits would have been the incentive to construction.

Value of Coal Exaggerated

"Alaskan coal is of great value, but its extent and character have been much exaggerated. There are great quantities of lignite and low-grade bituminous coal in several parts of the Territory, but there are only two known fields of high-grade coal in Alaska. The better known of these two fields is the Bering River field, which is near Controller bay and in which the Cunningham claims were located. It is the field about which the Alaskan controversy has been fiercest and most bitter. The Matanuska field is larger and may prove to be the more important. Both of these fields contain anthracite and high-grade bituminous coals.

"If Alaskan coal is to be mined and sold under any plan, it is important to know what is likely to be the present and future market. There is at present on the Pacific coast no available anthracite, except that in Alaska. It would be natural, therefore, to expect an immediate demand for this particular kind of coal. There is little high-grade bituminous coal on either the eastern or western border of the Pacific, and it would be natural to expect a considerable demand for coal of this character. There is little if any high-grade coking coal on the Pacific unless in Alaska, and there is an immediate demand for a certain amount of coking coal for smelting copper and other ores.

Market Limited and Uncertain

"Vast deposits of copper are already known to exist in Alaska and smelteries will undoubtedly be established in that country as well as farther south upon the Pacific coast. Some iron exists in the Pacific States and there are numerous indications of its presence in Alaska, although commercial development there is as yet practically negligible. My own judgment is that the present market for Alaskan coal is limited and uncertain, but that the demand will rapidly increase as the country is developed. After all, however, important as these needs and opportunities are, it seems reasonably clear that Alaskan coal will not dominate the coal market of the Pacific coast, as it was confidently thought it would when the fields were first discovered. I personally visited the Bering field and examined some of its coal veins and coal mines. The country is exceedingly rough and broken and the rocks are faulted and folded to an extraordinary degree.

"In addition to the titanic upheavals which must have occurred at this point the stratification has slid or moved within itself in such a way as to crush the larger portion of the coal beds in this field, leaving what otherwise would have been the highest grade of bituminous coal so that much of it cannot be mined as lump coal, but only in a finely crushed condition.

"One of the pressing needs of the Territory is the construction of smelteries at which the copper ore can be smelted without the labor and expense of transporting the ore the enormous distance now necessary for this purpose.

"The exploitation and commercial development of these ores would promptly follow the construction and operation of such smelteries. Representatives of the Copper River railroad state that they will immediately construct a branch line to the Bering coalfields as soon as they are opened to development.

Controller Bay No Harbor

"As the Controller Bay region is only 20 to 30 miles distant from the coalfields, there have naturally been numerous investigations to determine the possibility of constructing harbor facilities there. I am told that it was carefully investigated on behalf of the Copper River railroad by engineers of high standing and was discarded as impracticable.

"Obviously if modern dockage is provided at Cordova for copper ore and other heavy freight, it can be made to provide for coal with less additional expense than if separate facilities should be constructed on Controller bay.

"If a Government railroad is desirable now or in the future, there is ample opportunity for it. However, under the conditions which exist and the fact that the Copper River railroad is already in the field, I see no reason why the Government should at this time take upon itself the unnecessary financial risks of supplying transportation.

Future of Matanuska Coalfield

"My visit to Alaska has led me to take a far greater interest in the future of the Matanuska coalfield, which is larger in extent (having an area of 74 square miles, or 47,360 acres), better in coal, better in physical condition and freer from the complications of private claims than is true in the Bering River field. Against these advantages must be set off its greater distance from the sea, but this very distance connects it more intimately with the real problem of Alaskan development, that of adequate transportation from tidewater to the Yukon. What Alaska needs more than all else is a trunk-line railroad from the ocean to the great interior valleys of the Yukon and the Tanana, opening up the country so that its future development may really be possible.

Leasing System Advocated

"It remains only to consider more in detail the methods by which the coalfields should be opened. Those suggested have been the sale of the lands in fee, their development under lease from the Government and their operation by the Government itself. I believe that the time has passed when the Government should convey an unrestricted title to its coalfields. The day is done in which the Government should deliberately encourage the unrestricted private exploitation of the sources of power.

"On the other hand, direct Government operation, including the mining and the selling of coal, involves such deep and far-reaching changes both of policy and

of administration that there is no likelihood at present of its adoption to the exclusion of private operation.

"I believe that the leasing system avoids the controversies and the difficulties of both extremes of public and of private ownership."

The Question of the Public Lands*

The public would be less surprised at the great number of Federal indictments found against individuals and large corporations if it understood how inadequate are the laws to the present requirements of the country. The existing land, mineral, coal and timber laws were passed, often in ignorance, when the country was in a far less advanced stage of industrial life than it has of late rapidly attained. They were liberal to a fault and were intended to tempt population into the country (they succeeded in so doing) and to induce capital to undertake the development of its resources. Public lands have been given away to natives of every foreign country, except China; the coal lands have been sold for a trifle, so that only the least desirable in locality or in quality of fuel remain unsold; our mineral resources are alienated almost without any compensation to the State; and to induce the building of railroads, general State and Federal acts encouraged the construction of competing roads, and the Government gives the right of way gratuitously over the public domain.

The result has been what was expected—and a little more. It is this little more which is at present exciting so much indignation and causing the demand for a perhaps too radical reversal of the old policy. The farmer who paid nothing for his land is crying out against the railroad corporation which paid nothing for its franchises; and all are shocked at the enormous fortunes made out of our national mineral resources, which were virtually given away, and from which the public in its ignorance cannot see that it is deriving any benefit.

It is certainly high time to consider the subject calmly, to trace effects back to their causes, and to remedy the evils incident to the policy adopted; but there is no justice in heaping abuse on those who have taken advantage of one policy, and worked it out to its inevitable issue. But for that policy our population would not be 90,000,000; we should not have 230,000 miles of steam railroads and 30,000 miles of electric roads; we should not be making more copper than is made by all the rest of the world; and we should not stand far ahead of all competitors in the manufacture of iron and steel. The men were found to accept the policy of the nation, and to work it out to its fulfilment. They should be commended; but the evils which the policy has inevitably engendered should be calmly reviewed, and the remedy applied; not by exciting class against class, by making a political issue of the evils and their proposed cure; but by endeavoring to trace them back to their source, by discovering some correction for the defects of the system, and passing amendments of our laws without abolishing such features of the system and laws as have undoubtedly effected widespread good.

The laws should probably have been amended before this, as population increased, and the conditions of trade and commerce changed from those which existed when they were passed, and when it became apparent that industrial operations could not be conducted without infraction of some of the provisions which, apparently wise at the time when they were enacted, have unquestionably become antiquated and detrimental.

The laws in which our readers are most immediately interested are those affecting the acquisition of coal and mineral lands. With regard to the former, the President sent two messages to Congress at its last session, urging that legislation be passed to correct admitted defects. In his message of Dec. 17, 1906, he said, "I am gravely concerned at the extremely unsatisfactory condition of the public-land laws, and at the prevalence of fraud under their present conditions. For much of this fraud the present laws are chiefly responsible . . . . . The present coal law limiting the individual entry to 160 acres puts a premium on fraud by making it impossible to develop certain types of coalfields and yet comply with the law. It is a scandal to maintain laws which sound well, but which make fraud the key without which great natural resources must remain closed." In his message of Feb. 13, 1907, the President, citing 2300 cases of public-land entries in four districts, said that noncompliance with the law was found in more than half of them, and deliberate fraud in very many cases.

In response to his warning not less than 10 bills were introduced in the Senate and House of Representatives during the last session of Congress. They all agreed that the unceded coal and oil lands should be retained in whole or in part by the United States. Some of the bills suggested a rental price, some of them a royalty, and some of them both. One of the bills advocated a perpetual lease under conditions. Most of them, however, limited the lease to a period of years—one 30 years, and another 25 years. There was considerable variation in the different bills as to the size of the area which any individual or corporation should own. All of the bills left a large margin of interference by the Secretary of the Interior, one going so far as to allow him to fix the price of coal mined from leased mines. When a bill covering this question is passed, it is hoped that it will be so explicit as to require as little interference as possible by the Department in carrying out its provisions. That a limit should be put to the time of the lease, as long as the rental is paid, seems unreasonable. If the rental is high enough, and the national treasury therefore acquires the value that it demands, one tenant might be assumed to be as good as another tenant, provided the restrictions as to the methods employed in mining are strictly enforced on both. The heavy expense involved in opening and equipping mines and coking plants would never be undertaken on a short lease of a small area. Interference with the price of the product would simply be playing into the hands of the owners of the still larger areas of land whose titles cannot be interfered with.

When, therefore, it comes to the framing of a bill, it ought to be in the simplest terms compatible with the receipt by the Government of a proper revenue, and the imposition of proper conditions for safe working and economical recovery. If the rental is high enough, and the area large, the gross rental paid will prevent individuals or corporations from selfishly holding a larger undeveloped territory than they see the possibility of utilizing profitably within a given period.

The present law with reference to coal allows an entryman to locate 160 acres and four entrymen to combine and organize an association, but requires the entrymen to swear that he has made no arrangement to dispose of his 160 acres. The wording of this clause of the entryman's affidavit is: "That I am now in actual possession of said mines, and make the entry in good faith for my own benefit, and not directly, or indirectly, in whole or in part, in behalf of any person or persons whomsoever."

The affidavit is so worded, under certain interpretations, that it renders every entryman liable to prosecution for perjury who has even a remote intention of selling his claim, and not working it himself. As the Department knows, every body of coal lands large enough to be economically worked has been acquired by entrymen who were techincally guilty of fraud. But the law has been generally administered with reasonable latitude. There is a difference between cases (1) where entrymen have taken up coal lands, with the expectations of selling them, and paid for them, even if with borrowed money for which they have given their claims as security; and (2) cases where coal lands have been taken up under the Homestead Act, or with scrip applicable only to agricultural land, and the Government defrauded out of $10 or $20 an acre due the country. However, when it pleases the Department of Justice to make a

*An editorial published in the ENGINEERING AND MINING JOURNAL, Dec. 21, 1907.

record for vigilance and activity, and it sends forth an army of special attorneys and special agents, whose jobs depend upon their securing indictments, there is no difficulty in obtaining by the thousands apparent breaches of the above affidavit, and persuading grand juries to bring indictments, though these agents of the Department of Justice are perfectly aware that their efforts will seldom be rewarded by conviction.

Resuming, however, the discussion of the main features of the law which limits each entry to 160 acres: Such a small area, even when covering a 6-ft. vein, at the rate of 8000 tons to the acre, renders available only 1,280,000 tons of coal. Four entries will contain substantially 5,000,000 tons.

Most Western coal costs for extraction about 80c. per ton, and sells as run-of-mine, in ordinary times, at $1.15 a ton on cars, leaving 35c. per ton profit to cover the cost of the coal lands, the cost of mine opening, the cost of safety appliances, such as blowers to insure ventilation and batteries and wiring for electrical firing, and the cost of a tipple for loading cars.

If the coal is a coking coal, there must be provided a washery for separating the slate, and ovens for coking the washed coal. Inasmuch as most Western coking coals carry 12 to 15 per cent. of ash, and as two tons of coal generally enter into one ton of coke, the ash of the coke would be 25 to 30 per cent. and would render it almost worthless for metallurgical purposes. The crushed or screened coal is, therefore, submitted to the process of mechanical washing, by which the slate is more or less perfectly separated from the coal. This is merely preparatory to the operation of coking, for which an expensive plant, with trolley systems for charging the ovens and railroad cars and tracks for carrying away the coke products, has to be provided.

The demand for coke in the Southwest has grown beyond the capacity of the Western plants to provide it, and the equipment of the railroads to handle it. This is true to such an extent that to supply the extraordinary needs of Arizona and northern Sonora alone there were imported in 1906 and the early months of 1907 about 350,000 tons of coke from Connellsville and West Virginia.

In order, however, to render this section of the Southwest self-supporting, there are at the present time being erected in northern Mexico washeries and coke ovens which will cost at two establishments alone, $4,000,000. These two establishments—to supply the demands of the railroads and smelteries which look to them for fuel in the form of coal and coke—must mine not less than 250,000 tons of coal a month, or empty the 6-ft. beds of one quarter-section every five months, or extract all the fuel from the maximum area, which can be consolidated legally, in 20 months.

The construction accounts of a certain Western coal-mining and coke-manufacturing company show, for example, that there was appropriated for the coke-oven plant $750,000, and it cost slightly more; for the power-generation plant for running the trolley system within the mine and between the mine and the tipple, ovens, washery and pumping plant, $207,000; for a washery, in a thoroughly fireproof building, $250,000 was appropriated, and the cost reached $300,000; for merely developing two new openings, building railroad approaches, and putting them into condition to produce coal, $40,000; and for introducing electric shot-firing system into each of six mines, $3200. The total cost of this one installation will be fully $2,500,000.

Allowing, therefore, even 40c. per ton profit on the coal, and this is more than the average profit on coal which enters the coke ovens as well as the market, the gross profits from the coal contained in four quarter-sections would be $2,000,000, or only 80 per cent. of the cost of installing the surface plant of the establishment in question. No small mine could supply such a quantity, and no reliance for regularity of supply could be placed upon a number of small mines owned by farmers or poor individual operators. Only corporate wealth under corporate management could work on such a scale and erect such costly plants, and neither the banks nor the public would subscribe to a company doomed to such speedy and ruinous extinction.

There is another anomaly in the law affecting the purchase of coal lands: The entryman must swear that he has discovered coal. Coal beds generally crop out along one exposure, and the coal at any great distance from the outcrop must be reached by sinking before it can be mined, or by boring before it can be claimed under a coal entry. But the cost of determining its existence by these expensive methods is beyond the financial resources of the poor man. If, however, he secures the surface under the Homestead or other entry, knowing the land to be more valuable for coal than it is for agriculture, and is aware that he is locating over valuable coal beds, he is subject to prosecution, and if coal is actually discovered on his Homestead entry, though he was ignorant of the fact when he made it, he is certain to get into trouble. In fact, the anomalies of the law are very manifest and very curious. A farmer, for instance, took up land under the Desert Land Act. The law requires that certain portions of such land under every entry shall be irrigated. He intended to do so, but found that by constant scrupulous pulverization of the soil during the growth of the crop, he could raise it without irrigation. The ingenious and enterprising man is being prosecuted for fraud for disobeying the law upon which he has so notably improved.

There is, however, no question that when infractions of the law come to be generally made, even with knowledge and concurrence of the Government officials, such a laxity leads to a certain obliquity of vision and opens the door to fraud of every kind. There is, moreover, and perhaps as a consequence, little doubt that very large quantities of coal land in the public domain have been secured under Homestead and other entries, for which the Government received nothing. The President's action in withdrawing temporarily all coal lands from entry is, therefore, commendable from a national economical standpoint, provided his action be followed speedily by good legislation. Meanwhile, the innumerable suits for infringement of the law in the past, even though these infringements in most cases have been strictly in conformity with usage well understood and recognized by Government officials, will undoubtedly have the effect of making both the public and the Government officials more scrupulous in the future than they have been in the past. But considering the glaringly defective character of the laws, the Department of Justice ought to discriminate between cases of technical shortcomings, inevitable under the statutes if the requirements of the country's trade as well as obedience to the law are to be observed.

The New Tin Contract of the London Metal Exchange

We give below the substance of the new rules for selling tin on the London Metal Exchange, which are an important departure from the old rules. The new regulations have been definitely adopted, to take effect Feb. 2, next.

Deliveries of Tin

Sellers have the option to deliver each five tons, either in: *Class A* (1) Straits or Australian tin of good merchantable quality at contract price. (2) Refined tin of good merchantable quality, assaying not less than 99.75 per cent. at contract price.

Class B—Common tin in ingots or slabs of good merchantable quality, assaying not less than 99 per cent., subject to a rebate of £7 per ton from contract price.

Rules

Rule 1—The warrants tendered shall be those of a public warehouse in London, Liverpool, or Swansea, the name of which shall appear on the official list of the committee (of the Metal Exchange). The tin shall have been weighed in drafts of 10 cwt. each, and the warrants shall be as far as possible for five

tons each. Each parcel of five tons shall be of the same description and class and shall lie at one wharf; but sellers shall be at liberty to tender parcels of five tons composed of metal of the same description and class, but lying at different wharves in the same port, in which case they shall allow buyers 5s. per ton for each five tons so divided. Warrants tendered against a contract for a multiple of five tons shall, either separately or together be capable of subdivision into parcels of five tons each.

Rule 2 provides for the sampling of Straits and Australian tin by taking one sample from each lot to be delivered to the buyers.

Rule 3—Straits and Australian tin, if below the standard of good merchantable, shall not be considered a valid tender; and sellers shall substitute a similar quantity of standard tin. The rest of this rule provides for the time allowed for substitution.

Rules 4 and 5 provide for the methods of drilling, sampling and testing. *Rule* 6 provides that all warrants shall be accompanied by certificates from assayers approved by the committee. If there is delay in furnishing the certificates, buyers may hold back 10 per cent. of the price until the certificates are furnished. *Rule* 7 provides for the rejection of tin not coming up to the standard, and for the substitution of other tin; also for arbitration in case of dispute.

Rule 8—Sampling shall, in all cases, take place independently by the wharfinger at the public warehouse, and the entire cost thereof and of the assaying and testing shall be borne by the sellers.

EFFECT OF THE CHANGE

The result of the changes will be to broaden the market by permitting the delivery of a number of brands which are well known, but have heretofore been excluded. Under the old rules only Straits or Australian tin constituted a good delivery.

The Largest Turbogenerator

An interesting event took place at the plant of the New York Edison Company, on Nov. 3, 1911, when the largest completed electric generating unit in the world was started. It was hoped that Mr. Edison would start it in person, but sickness prevented him. The turbine is of the Curtis type, manufactured by the General Electric Company, and the generator has a capacity of 20,000 kw., or 30,000 h.p.; this is sufficient to light 1,000,000 incandescent lamps, 16 c.-p. each. When the installation is complete, three of these 20,000-kw. machines will occupy a space formerly taken up by four of the old 3500-kw., engine-driven units, which were previously in use. Each machine requires 400 tons of coal per day and uses 80,000 cu.ft. of air per min. for cooling the generator windings.

United States 1910 Pyrite Output

The production of pyrite in the United States in 1910, according to W. C. Phalen, of the U. S. Geological Survey, amounted to 238,154 long tons, as compared with 247,070 long tons in 1909. The falling off in the pyrite industry was due to diverse causes in different parts of the country. The same States produced pyrite in 1910 as in 1909, with the exception of Alabama and Pennsylvania, though the latter State has never been an important producer. The absence of Alabama from the list of producing States, the curtailment of the production of California and of Georgia, the decrease in the Massachusetts production due to the cave-in of the old Davis mine, near Charlemont, and the falling off in Ohio due to strikes in the coal mines, have all contributed to the slight decline in the production of pyrite. Virginia gained notably both in quantity and in value of output, but not enough to make up for the losses in the States above mentioned.

California ranked third in 1910 in the production of pyrite. The output of the State fell off greatly from that reported for 1909 and was the lowest figure of this State for several years. California pyrite comes from near Oakland and Fruitvale, Alameda county, and from near Keswick, Shasta county. The production of pyrite in Georgia was considerably less in 1910 than in 1909. The Georgia pyrite came from Villa Rica, Carroll county, about 30 miles west of Atlanta. The production for 1910 in Illinois showed an increase of 36 per cent. over the preceding year. Illinois now ranks fifth among the States in the production of pyrite, which is obtained as a byproduct in the mining of coal. In Indiana the pyrite is also obtained in mining coal.

The production of pyrite in Massachusetts is still falling off. The only producer, the Davis Sulphur Ore Company, is not operating the old Davis mine, which for many years has furnished the only pyrite reported from this State, but is simply cleaning up the property. The only shipments being made in January, 1911, were the concentrates obtained from milling the waste dumps.

The St. Lawrence Pyrite Company, situated near Stellaville, St. Lawrence county, was the only producer in New York in 1910. Ohio pyrite is obtained in connection with the mining of coal, and owing to a strike many of the pyrite-producing coal mines were closed more than half the year. As heretofore, Virginia led in the production of pyrite in 1910. The pyrite is mined principally in Prince William, Louisa and Pulaski counties. Wisconsin is becoming an important producer of pyrite. The pyrite is obtained through separation from zinc blende by electrostatic methods. The importation of pyrite into the United States still greatly exceeds the domestic supply.

Oakland City Oilfield, Indiana*

BY RALPH F. BLATCHLEY

What is known as the Oakland City oilfield is situated about 3½ miles east of Oakland City, in Pike county, Indiana. No production has been found outside of the district thus defined. Within this area there had been drilled, up to Dec. 1, 1910, 201 producing wells, 18 gas wells and 32 dry holes. On the above date there were 13 drilling wells within these limits. The pool as it now stands is approximately four miles long and two miles wide at its widest place.

The history of the Oakland City field dates back probably 10 years, when a company of Oakland City business men looking for gas put down a bore north of Oakland City in Gibson county on what was then the Alcorn farm. This bore was drilled to a depth of about 1100 ft. It is said that the same salt sands and limestone formations were passed through as are found in the present field. In August, 1908, the first producing well in the field was drilled. The usual excitement following a strike in a new territory ensued. Of the many holes drilled two others proved to be producing wells. Drilling then centered around these three producers and gradually the operators felt their way until they have reached all but the northern limits of the pool. In a general way the field may be said to have begun in the southern end and gradually moved north.

The "drop-off" in production of oil in wells in the Oakland City field is pronounced. Wells in the mile-wide territory that comprises the main producing territory of the field have an initial output of from 100 to 200 bbl. and even as high as 285 bbl. daily. In these wells, as a general thing, the production declines in about 30 days to 40 or 50 bbl. daily and from that gradually to 10 bbl. in about a year's time and holds fairly well at that point. The standard price paid for drilling in the Oakland City field is one dollar per foot. A greater price, of course, was paid when wildcatting was first being done in the field. The average time taken to complete a well is 20 days, barring all accidents.

On Sept. 1, 1912, a weights and measures law will be put in force in Bosnia-Herzegovina province, Austria-Hungary, rendering the use of the metric system compulsory.

*Abstract of article in report of Indiana Department of Geology and Natural Resources, 1910.

First Aid to Mining Machinery—V

By Henry M. Lane *

The methods of melting and casting brasses, bronzes and bearing metals differ from those employed by the iron founder because these alloys are easily oxidized. They must be melted in crucibles and the surface kept covered. Such alloys shrink more than iron.

*Editor, *Castings*, Caxton building, Cleveland, Ohio.

The casting of other metals at first sight appears more simple than the casting of iron, but in reality is more complex, the reason being that while these metals melt at lower temperatures, they oxidize more easily, and are seriously affected by oxidation. This class includes principally brasses and bronzes, but in late years the alloys commonly used are so complicated that it is difficult to classify them according to the old system.

Composition of Brasses and Bronzes

Strictly, a brass is a copper-zinc alloy containing one-third zinc and two-thirds copper; whereas a bronze is a copper-tin alloy containing approximately 10 per cent. tin and 90 per cent. copper. The old-style gun metal contained from 90 to 92 per cent. copper and from 8 to 10 per cent. tin. Lead is frequently added to both these classes of alloy to make them machine more easily, and both tin and zinc are commonly used in the same alloy, so that today we have a series of copper-tin-zinc alloys of almost infinite variety. In all cases in the useful alloys of this class, however, there is present more than 50 per cent. copper.

In a copper-zinc alloy or what is commonly known as a brass or yellow metal, all the constituents are soft and the alloy is more or less malleable until more than 35 per cent. of zinc is present; beyond this point a hard constituent or compound appears in the alloy, so that it is no longer suitable for bearing purposes.

In most of the modern alloys tin is depended upon to give strength and zinc to cheapen the mixture. Some of the old-style gun metals contained as much as 16 per cent. tin and 84 per cent. copper, but such metals were brittle and hard. The common yellow brass employed by plumbers in making ordinary valves and fittings may be considered as composed of approximately 16 lb. copper, 8 lb. zinc, and ½ lb. lead. It will be noticed that this consists of approximately one third zinc and two-thirds copper, with a little lead added to improve the machining qualities. For the making of high-grade casting ingots or new metal should be used in all cases. In making a brass the copper should be melted first and the zinc added, care being taken not to let the temperature rise too high for if it does the zinc will ignite and burn. The lead is added last and the metal thoroughly stirred.

Graphite Rods for Stirring

Many foundrymen use an iron rod for stirring any kind of brass or bronze alloy, but where this is done more or less of the iron will be absorbed, rendering the metal harder. If it is intended to be prepared for making brass or bronze castings, graphite stirring-rods should be provided. When melting any brass or bronze alloy the metal in the pot should be covered with powdered charcoal; some foundrymen use a fusible flux on top of the metal, as broken glass, borax, or a mixture of soda and sand.

Quality of Ingredients Required

The copper used for most classes of work can be what is known commonly as casting copper. This may be either of the electrolytic or Lake grade, if purchased in America, or a high-grade casting copper in other countries. For fine work nothing but high-grade electrolytic copper, Lake copper, or highly-refined copper should be used. The zinc used for making a brass alloy should be as pure as possible. If scrap is used in the mixture, it should be melted with the copper and then a sufficient amount of zinc and lead added to bring the composition to that desired. In melting any brass alloy some of the zinc will be oxidized or volatilized, and hence when scrap is used it is always necessary to add some new zinc.

As a rule brass alloys are to a large extent self-cleaning, that is, the oxidation of the zinc and its fluxing remove any other impurities from the alloy and prevent the absorption of oxygen. This is not as common in the case of copper-tin alloys. Pure copper is exceedingly difficult to melt, on account of its affinity for oxygen.

With alloys containing tin the red brasses and bronzes are approached. Ordinary engine brasses are commonly made from an alloy containing 13 lb. copper, 2 lb. tin, and 2 lb. zinc. Sometimes a small quantity of lead is added to improve the machining qualities. In making an alloy of this kind it is well to use a little phosphor-copper or phosphor-tin to help clean the metal and cause it to pour properly, so as to form sound castings. It is necessary to use only a relatively small percentage of phosphor-copper or phosphor-tin in the mixture as it is not the intention to leave any free phosphorus in the finished alloy. Phosphor-copper and phosphor-tin can be purchased from any metal dealer or foundry supply-house. For pump parts a bronze that is frequently used is composed of 88 parts copper, 10 parts tin and 2 parts zinc. It will be noticed that this is practically a gun metal to which a little zinc has been added.

Function of Deoxidizers

Aluminum should not be used in brass and bronze alloys, for while it is a deoxidizer it has a bad effect on many alloys and the aluminum oxides do not seem to free themselves readily from the metal. Phosphor-tin or phosphor-copper are far better deoxidizers. The best way to keep metal clean is to prevent its becoming foul, that is, to melt all alloys under an ample cover of charcoal or to use a little flux on each pot. The flux or charcoal must be skimmed off before the metal is poured. As already stated, in one of the previous articles, brass or bronze must be melted in graphite crucibles. These are heated in a small pit-furnace fired preferably with coke or anthracite coal, though it may be fired satisfactorily with charcoal. Oil-fired furnaces are also on the market and in regions where fuel oil is plentiful a satisfactory oil furnace can be made by building a small firebrick pit about six inches greater in diameter than the diameter of the crucible to be used. The crucible should be set on a small pier of brick built in the center of the furnace, or it may be placed on an old crucible turned bottom side up. The oil flame should enter near the bottom tangentially, so that it will circle around the pot; the outlet for the gases should be near the top of the furnace.

Crucibles for Brass Founders

In America crucible makers number their crucibles by an arbitrary series of numbers in which each number corresponds to one-third the capacity of the pot for pure copper or bronze. For instance, a No. 20 crucible will hold 60, a No. 80 crucible 240 lb. of copper. As a rule, however, crucibles are charged with about 10 per cent. less than their rated capacity.

Some founders prefer to melt with a forced draft, bringing down the metal in a No. 40 pot in from one hour and a half to an hour and three quarters. This rapid melting is rather hard on the pots, and a longer life will be obtained from the crucibles if from two to four hours is taken in the melting. The longer melting time, however, gives greater opportunity for the absorption of gases, hence the metal

must always be kept covered with charcoal or a fluid molten flux. When graphite crucibles are first received they should be placed in a warm and dry place, so that they will become thoroughly dried. There is frequently some place about the boiler where this can be accomplished. If not, it may be necessary to construct a small dry room and warm it with coke or charcoal. If a core oven is at hand crucibles may be dried in it. Preferably the crucibles should be dried for several days, at a temperature of from 200 to 250 deg. F. Before a crucible is put in use it should be annealed by heating it slowly to a bright red heat, and this process should occupy several hours. The crucible can then be charged while hot or it can be allowed to cool, filled with metal, and returned to the furnace. After a crucible has been thoroughly dried and annealed it is not likely to crack if exposed to sudden changes of temperature, but if these precautions are not taken the crucible is liable to break the first time it is used.

Order of Adding Ingredients

No matter what is the metal being melted, the material having the highest melting point should be introduced first and melted. If scrap is being melted, the coarsest scrap should be melted first and the finer material added to the molten mass in the crucible. At no time should the metal in the crucible be heated above the temperature at which it becomes thoroughly molten. If fine scrap such as turnings and borings or fine wire is to be melted, some coarser scrap or ingot metal should be melted down first so as to fill the crucible about half full of molten metal. The fine material should then be introduced into the crucible and pushed down into the molten metal with a rod. To prevent the oxidation of material of this kind an old crucible should be taken, the bottom knocked out, and this may be used as a funnel for feeding the fine material into the pot.

If fine material such as sheet-metal clippings or old wire is to be melted down for future use it is well to form the wire into compact bundles by pounding it into an iron mold as for instance, an old mortar. These bundles, which are known in the trade as "cabbages," are then melted at the lowest possible heat. After the metal is molten it is poured into ingots at as low a heat as possible. Later these ingots are used in the regular mixtures. To pour sand-molds it is necessary to have the metal from two to three hundred degrees Fahrenheit hotter than would be necessary to pour it into open ingot-molds, and hence the method described reduces the losses from oxidation and the volatilization of zinc.

Molten metal which is composed largely of copper can be cleaned by poling, that is, by stirring it with a green wooden-pole. If pure copper is being treated in this way, it should be stirred until a sample taken and poured into a small button freezes with a level surface, showing neither depression nor swelling. If the stirring is continued too long, the metal will be injured by the absorption of gases.

The tin used for alloys may be of two classes, known to the trade as grain tin and block tin; both are received in ingot or pig form. The grain tin is the highest grade. In adding tin to copper care must be taken not to get it too hot, or the tin will take fire and burn. The copper is melted first and then the proper amount of tin added. Some founders prefer to melt the large pigs of tin and pour them into small ingots of suitable size for adding to the alloys, while others saw or cut the tin into pieces of suitable size.

For placing the crucible into the furnace and removing it therefrom, a pair of crucible tongs, which will reach over the top of the crucible and grasp it below the broadest part, which is known as the bilge, must be provided. After the crucible is pulled from the furnace it is set into a single- or double shank like those which have been described for use in casting iron and is taken directly to the floor and the metal poured from the pot in which it was melted. Just before pouring the surface of the metal must be cleaned with an iron skimming rod.

Melting Bearing Metal Mixtures

For bearing metals, a class of white alloy is commonly used. For lining iron boxes the old style babbitt metal is the standard. This is composed of 88.9 per cent. tin, 3.7 per cent. copper and 7.4 per cent. antimony. The alloy must be made in two stages to insure proper blending of the ingredients and to prevent the oxidation of the more volatile constituents. First, melt 12 lb. of copper in a crucible and add to this 36 lb. of tin, next add 24 lb. of antimony, and then add another 36 lb. of tin, taking care at all times to keep the temperature as low as possible, just keeping the metal molten. This alloy is thoroughly stirred and poured into ingots. These ingots are then remelted with twice their weight of tin to form the final alloy, which is cast into suitable ingots for use as may be desired. The final alloy may be melted in an iron crucible. A graphite crucible, however, is necessary for making babbitt metal, on account of the high melting point of copper.

Molding for Alloy Castings

The molding operations required for the production of brass castings are similar to those required in the making of iron castings, but on account of the fact that molten brass or bronze is more fluid than molten iron it is necessary to use finer sand mixtures, both for the molding and the core sand or else the surface of the cores must be covered and the mold properly faced to prevent the brass from flowing in between the grains of sand.

If brass molding is to be done regularly a supply of suitable molding sand is to be secured from one of the regular foundry supply houses, but if only an occasional casting is to be made, fair work may be obtained by selecting the finest molding sand used and then sifting it through a No. 16 sieve, using the fine material as a facing.

Where the sand available is rather open in its nature it may be necessary to partially close it by using some clay in the mixture and then skin-drying the mold. This latter process is accomplished by hanging a sheet-iron basket over the face of the mold, filling it with charcoal, and allowing the charcoal to burn, or the mold may be set up with its face a few inches from a cast-iron stove, brought to a good temperature, or it may be dried next to an ordinary coke-fired salamander. This latter is simply a basket made of iron rods in which a coke fire is maintained.

Facings for Skin-dried Molds

Where brass molds are to be skin dried the surface is frequently sprayed with molasses or glutrin. The surface may also be improved by smoking it. This is acomplished by turning the mold face down supporting it by the ends, and taking a little rosin in a suitable hand ladle or other pot, setting fire to it so that it will burn with a smoky flame, and then passing it under the face of the mold until the latter is covered with a thin coat of fine black soot, which forms an efficient facing. In making molds for brass work care must be taken to prevent the introduction of anything into the sand which will tend to coarsen it, and for this reason coarse parting sand is not suitable, hence many founders prefer to use a mixture of powdered rosin and charcoal or powdered charcoal, as parting. There are also special parting compounds which are furnished by the regular foundry supply houses. For large or heavy brass or bronze castings the face of the mold is frequently prepared by sprinkling flour over it from a bag made of cheese cloth. Fine plumbago is then sprinkled over the flour and the surface finished with a small trowel or slick. In molding operations of this kind the foundryman should have a pair of bellows with which to blow away any excess of facing material.

Owing to their relatively high specific gravity and their extreme fluidity brass and bronze alloys are liable to cut a mold and wash the sand more than iron. For this reason the pouring gates should be made to lead into the bottom of the mold wherever this is possible. This is particularly true in the case of large work. Small work is frequently poured by upending the molds so that the gate enters through one end of the flask, the cope and drag being clamped together with a board on each side.

Shrinkage of Brass Castings

Brass and bronze have a greater shrinkage than iron. The patterns for brass and bronze must have a shrinkage allowance of $\frac{3}{16}$ in. per ft., or in other words, if a shrink rule is to be used the bar to be graduated to equal 1 ft. must be $12\frac{3}{16}$ in. long. This bar is divided into 12 parts to represent inches, and the inch into eighths or sixteenths, as may be required.

The excessive shrinkage of brass or bronze alloys makes it necessary to have a core which will be crushed readily by the molten metal. Large cores should be made with a soft interior, and this is generally accomplished by filling the interior of the core with cinders, powdered coke, or some other similar material. It has already been stated that the core material must also be fine, and this necessitates the use of finer sands for brass-foundry cores than those commonly employed in iron-foundry work. When a brass casting has been poured and is shaken from the mold, care should be taken to keep the core sand out of the molding sand as far as possible. The cores for brass and bronze castings are sometimes blown out by shaking out the molds while the castings are still fairly hot, and then dipping the castings into water. The steam generated in the cores blows out the core sand. This also gives the castings a better color. Iron castings subjected to this treatment would be broken, but brass castings are rendered softer.

Precautions in Casting Brass

The precautions to be followed in the making of brass castings are:

Be sure that the crucible is dry and thoroughly annealed before putting it in the furnace.

Always keep the crucibles in a dry place, for if this rule is followed, as high as thirty heats can easily be obtained from one crucible.

Always melt the coarsest material and that having the highest melting point first, and then add the more volatile or easily oxidized constituents.

Always keep molten metal covered with powdered charcoal or a fusible flux.

After the metal is thoroughly melted, pour it as soon as possible, for if it is left to soak in the furnace it will absorb gases or become oxidized, and this will cause blow holes in the casting. It is better in many cases to err on the side of too rapid melting rather than to soak the metal too long.

Always keep the sand used for the making of brass castings separate from that used for the making of iron castings.

The use of a little phosphor-tin or phosphor-copper will tend to prevent blow holes in castings by removing oxidation troubles.

Be sure to use a sand fine enough so that the molten metal will not cut into it seriously, but if the sand is not fine, then use a facing mixture of talc or plumbago mixed with clay wash, or else treat the surface with flour and plumbago so as to prevent the metal cutting into the face of the sand. Cores should also be washed if the sand is at all coarse.

Tariff Decisions

The Board of General Appraisers last week rendered decisions on two questions involving the duties on metallic ores.

Zinc and Lead in Ore

A protest, filed by the United States Zinc Company against the action of the customs officials in making alleged excessive assessments on ores containing lead and zinc, was overruled. The protests involve the assessment of duty on ore shipments, all of which were assessed with both zinc and lead duties on the respective content therein of such metals, under paragraphs 181 and 193, act of 1909. The importers claimed that it was improper to levy a heavy duty on the same goods under both paragraphs, and that duty should have been assessed on the lead, or on the zinc contained in such shipments, as the case might be.

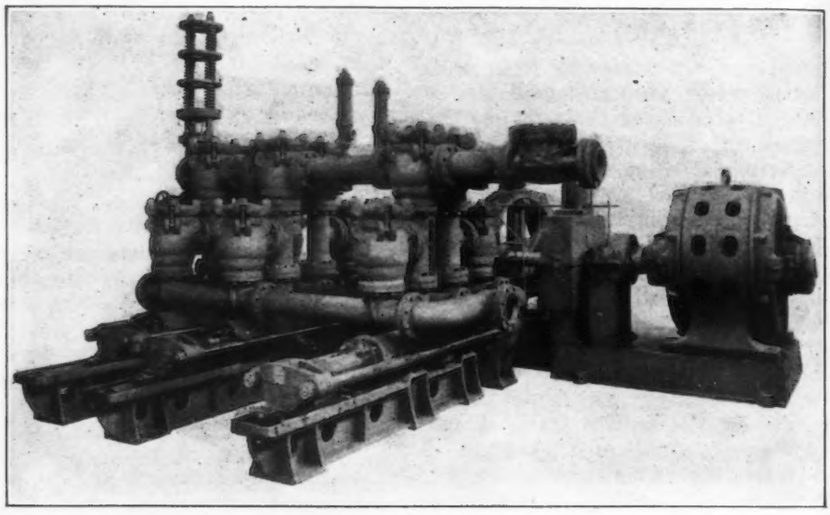
In denying the contentions raised by the importers, the board rules that where ore as imported contains both lead and zinc, the zinc appearing in a quantity exceeding 10 per cent., the metal content of both is dutiable, the lead under paragraph 181, and the zinc under paragraph 193. The assessments complained of are affirmed. Similar contentions made by the American Smelting and Refining Company and the Altoona Zinc Works were overruled.

Tungsten Ore

The board took adverse action on protests filed by the Mineral Products Manufacturing Company and O. G. Hempstead & Son, relative to the classification of wolfram ore. It was assessed at 10 per cent. *ad valorem* under the provisions of paragraph 190, act of 1909, as "tungsten-bearing ores of all kinds." It was claimed to be exempt from duty under paragraph 626 as "crude minerals not specially provided for." The collector's classification is affirmed.

Large Pump for El Oro

The El Oro Mining and Railway Company, of El Oro, Mexico, has just installed one of the largest motor-driven pump equipments ever built for unwatering a mine. The pump was built by the Goulds Manufacturing Company, Seneca Falls, N. Y., is its Fig. 1521 type, size, 6x20 in. and has a capacity of 500 gal. per min. The construction is such that the pump can be readily dismantled and lowered down an ordinary mine shaft and when assembled it requires little headroom.



Large Motor-driven Pump for El Oro Company

The pump will be installed in the bottom of the mine and will pump against a head of 1300 ft. The driving motor is a 200-h.p., three-phase, 50-cycle, 440-volt, 485-r.p.m. Westinghouse motor, which is connected with double-reduction gearing, giving the crank shaft of the pump a speed of 35 r.p.m. This installation affords an excellent illustration of the advantages of the electric-driven pump in mine service.

Manganese Ore Production

In 1910, manganese ore was mined in the United States only in Virginia and Arkansas. The production for 1910 was 2258 tons, valued at $22,892, as against 1544 tons for 1909. Large quantities of manganese are imported. Of manganiferous ores containing but a small percentage of manganese, the production was much greater, amounting in 1910 to 619,735 long tons.

The Policy of the Steel Corporation

By E. H. Gary*

The Steel Corporation aims to obey the laws and to follow a middle course between destructive and restricted competition. Difficulty in interpreting the Sherman law.

*Chairman of board of directors of the United States Steel Corporation.

I think, perhaps, it is well for all of us[1] to have repeated and made more emphatic some of the important questions which we must necessarily consider almost day by day. We are engaged in a very serious business and have great obligations. I need hardly say that all of us have been very much disturbed by the intimations published from time to time that the Steel Corporation has been the object of adverse criticism by some of the leading men of the country, if not by some of the officials connected with the Government. These intimations, whether based on facts or not, have been most distressing to me, and no doubt have affected you in the same way.

Aims of the Corporation

I think we have been of the unanimous opinion for a great many years that if the corporation could permanently succeed it must be on the basis of so conducting its affairs and of continuing such an attitude toward everyone interested in what it might do as to entitle it to the respect, confidence, and approval of everyone; and it has been our studied effort to negative any disposition on our part to do or permit to be done anything which could properly be complained of. That we have made mistakes and that some of our subordinates, without our knowledge and against our expressed wishes, may have been led into doing some things that we do not approve of we must admit.

But I think I am justified in claiming for you and for all of us that our intentions have been good and that those of us who have been in command, who have the responsibility and authority, whether as officials of the Steel Corporation or officials of subsidiary companies, have intended to conduct ourselves in such a way as to be all the time above reproach. However, because of the great position, influence, and standing of the Steel Corporation, I think it is proper for us to bring up from time to time, consider and emphasize to some extent at least, and in a general way, what is proper and what is not proper in the conduct of the great affairs and interests with which we are connected.

In the first place, we do not wish nor intend under any circumstances to countenance any violation of any law in force. I cannot say in language too emphatic that, not only from the standpoint of good morals, but from the standpoint of our personal interests, we must never make the mistake of intentionally violating, or permitting to be violated, any law which is in existence.

As good, loyal citizens we are just as much interested in the observance or the laws as the President of the United States or anyone else. We do not need to be compelled or urged by any public official to see the necessity of conforming to the laws of the country; we have just as much obligation in this respect as any other citizen. You know without my suggesting it that lawyers, and even judges, to say nothing of laymen, have been in more or less doubt as to what the laws mean. I am certain that doubt has not been removed up to the present.

Certainly we know that in trying to understand the application of the Sherman law, so called, we have been confronted by two extremes; on the one hand if we should have engaged in the destructive competition which naturally results from unrestrained selfish competition, we might have placed ourselves in a position which would justify the criticisms which have been applied to other large interests; that is, we might properly have been charged with attempting to establish or exercise a monopoly; on the other hand, if we had attempted to foster competition and to make it certain we were in nowise disposed to restrict competition by entering into agreements that we should not compete, we would have been in danger of violating another provision of the Sherman law, which is opposed to restraint of trade.

Restrained Market

Therefore, as you know and has frequently been referred to, it has been our disposition to conduct ourselves in such a way that we might be considered as occupying a position between these two extremes; and we have attempted, by the policy of coöperation, to conciliate our competitors, to assist them at all times, rather than to attempt to diminish their business for the purpose of increasing our own. And yet at the same time we have endeavored to influence, so far as we could properly, our competitors just as much against the undue increase of prices as well as undue decrease of prices, and we have endeavored to satisfy our customers that we were treating them fairly and properly. And then, above all, we have very fully and frequently published not only our acts, but our intentions.

I know that some of you from time to time have personally criticized the attitude of the some of the officials of the United States Steel Corporation. You have urged from your standpoint and from your viewpoint that our action and attitude were calculated to build up our competitors, and you have been more or less disappointed at times because we were not quite willing to favor your desire to extend your capacity as much as you thought the trade demanded, and so as to permit you to increase your capacity in proportion and comparison with your competitors.

I do not hesitate to say that I personally have been very much disturbed by this attitude on your part, because I recognized not only your keen insight into the situation, but your loyalty to the interest represented and your disposition to take care of the stockholders who could have no reason to complain of you for not being able to protect and promote your business to the extent your competitors were doing.

Self-regulation

Now we have approached the time when we are more or less in doubt as to what we ought to do, what is the safe thing to do, as well as what is the right thing to do. I believe that if we should be left to our own decisions, without interference from any source, we could and would conduct our affairs in such a way as to make it certain our company and companies were all the time of real substantial benefit to everyone who might be interested in our management, and of injury to no one. But the attitude of the public, certainly of public officials, seems to me to be more or less uncertain and indefinite, and we are left to decide in accordance with our best judgment and our ideas of right and wrong without any assistance from public officials.

It has seemed to some of us that under the present circumstances and in view of what has taken place and been published, it might be unwise for us at present to take any affirmative action with reference to maintaining the equilibrium of trade. We have heretofore for a long term of years endeavored to keep fully advised with reference to public sentiment and with reference to the conclusions and desires of those who are in authority in the matters in which the Government is interested and over which it has jurisdiction. And when we have found in any way that we were antagonizing public sentiment or the public officials we have endeavored to change our conduct and our attitude, so as to con-

[1]This address was delivered at a recent meeting of the presidents of subsidiary companies of the United States Steel Corporation.

form to what seemed to us to be the desire of the representatives of the Government or of those occupying high positions in any department of the Government.

While I have never had any intimation from any Government official that our action in regard to what we have termed coöperation was objected to, and, on the contrary, have understood from those sources that our action has been approved, yet we know that by some of the Congressional investigating committees we have been somewhat criticized. And some portions of the public press, acting on the information developed in these investigations, have intimated that we might be exceeding the limits of propriety.

Therefore, it has seemed to some of us that pending the consideration of these questions by the great public perhaps the better way for us is to place and keep ourselves in the attitude of being perfectly willing to listen to any suggestions from Governmental sources as to what we ought to or ought not to do, and at the same time, so far as practicable, at least refrain from taking any action which has been criticized by any of the representatives of the Congress or the press to which I have referred.

Avoiding Destructive Competition

I know it is for the best interest of our competitors, as well as ourselves and our customers, to avoid unreasonable and destructive competition. I wish the United States Steel Corporation and our subsidiary companies had it in their power to maintain fair and reasonable prices, not unchanged and unchangeable prices, not prices absolutely fixed from one end of the year to the other, but all the time fair, reasonable prices, so that everyone connected with the business might feel that there was no danger of such wide and sudden fluctuations as to bring about injury if not ruin to many.

I wish we were in a position where we could entirely satisfy our customers and also our competitors. I wish we could be of real substantial benefit all the time to our competitors, and to our customers; because we know that would be of benefit to ourselves and, what is more important, to the two hundred odd thousand men who are dependent upon us for continuous employment at good, fair, living wages. We do not seem to be in that position at the present time. Perhaps, if we knew more what was in the minds of those who have the right to call our action into question, we would be able to do so.

Groping in Uncertainty

Groping along in uncertainty, we are not able to determine what, if anything, we can do to bring about changed and better conditions with respect to the interest which I have adverted to.

You are, therefore, in the position to protect your stockholders in securing for your companies your fair share of business; also, in justice to your customers, you are obliged to see that they receive from you as low prices as are asked by your competitors; and yet, at the same time, you know that you must make it certain our conduct is so high toned, so fair and reasonable that you cannot justly be charged with attempting to drive out of business or to injure the business of any of your competitors. These conditions are very trying. You must not think that in this office we do not recognize the difficulties you encounter or the great responsibility which is placed upon you.

It has been of great benefit to you to have the friendship and to be entitled to the friendship of your competitors, and it is hoped you can go through the period through which you are passing at the present time without losing that friendship, without giving your competitors cause for complaint, without giving them the opportunity of saying you have taken their business away from them by unfair or unreasonable treatment.

Benefits for Steel Workers

I hope also that you will take especial pains to conciliate and promote the best interests of your employees. I consider this of the highest importance. I would like to urge and emphasize certain things. Make it certain at the time that the men in your employ are treated as well, if not a little better, than other men who are working for other people; make it certain you pay as liberal wages; that your hours are as good; that your facilities are as great; that your men are as comfortably housed where you have anything to do with the subject; that those who may buy from your stores, where you have any, purchase at as low a price or lower prices than they can buy elsewhere; that the sanitation is as good at your works as at any other place; that so far as you have control and influence your men are as a comfortable in every respect as the men in any other place; and, so far as you can, cultivate a feeling of friendship and influence your men to the conclusion that it is for their interests in every respect to be in your employ. I do not say this, gentlemen, merely from a standpoint of policy, although it is good policy to do everything which I have suggested.

But here again you are just as much interested in the questions as anybody else; it is not necessary to read in magazines or periodicals recommendations that you improve the conditions of your men; you are a part of the public; you are interested, as loyal citizens, in these great ethical and sociological questions; you are making a record not alone for your stockholders, but for yourselves. It is going to be said of you some time in the future you occupied high positions and you measured up to them, and you did your duty not only as representatives of large financial interests, but as public citizens. And I urge this upon you as being a part of the policy of our great aggregation of men.

It is more important all the time that we do the right thing concerning all the interests in our charge than it is that we make a good deal of money.

The Future

We may be conducting our affairs without any future prospect of being allowed even to live. I do not believe that is the fact; I believe in the last analysis the policies and principles which we have stood for will be properly recognized, and that we shall be allowed to go on in our work to greater success. Whether this is true or not is of little importance, comparatively speaking; we must make it certain we are doing the right thing.

There is another thing that I think of considerable importance. We may be in a somewhat different competition during the next few years than we have been during the last few years. As I have already intimated, I do not know exactly what the conditions may be, but from the fact that we have intentionally permitted competition to increase, have permitted our competitors to increase their capacity more rapidly than we have increased our capacity, we may find ourselves in a little different competition. We may be certain that some of our competitors will not all the time treat us as fairly as we treat them.

Efficient Organization Necessary

They may attempt to get our business away from us at times by undue means, although this should not influence our attitude or conduct; but, assuming that we may have greater or different competition than we have had in the past, it is evident that if we succeed we must first have the very best organization and the best management connected with the organization and talent, and we must be certain we are producing the best materials and at the lowest possible cost. I cannot emphasize this too much.

As I have substantially covered what is in my mind, I want to close by adding that we are just as proud of our organization as ever. It is a source of the greatest satisfaction to know that we have intelligent, honest, loyal officers and associates in carrying on this great work.

And so I close by saying that with feelings of appreciation and gratitude for what you have done and what you have been in the past, I now urge upon you greater diligence and greater effort, so far as you can and have the opportunity, to make it certain you are promoting the best interests of the stockholders of the United States Steel Corporation, and this without doing injury to anyone.

Chilean Milling in Peru

By B. L. Sackett*

An account of the old patio process as used for the beneficiation of Cerro de Pasco silver ores in which the prototype of the modern chilean mill was used.

*Mining engineer, La Fundicion, Peru.

The modern chilean mill, so well known and commonly used in many mining districts, is still working in competition with its prototypes, the original chilean mill of the Andes. It may still be the pleasure of one who wishes to make his way to the great mountain plateaus of Peru, to see many of these old mills, most of them, to be sure, in a condition of partial ruin, but some well enough preserved to be still in operation during certain seasons of the year. Not only will the old milling process itself be seen, but always in combination with it the Mexican patio process for the amalgamation of silver ores. Most of these mills and patios are not themselves of great age, perhaps dating back only 20 or 25 years, but the process is the same as used in this country as far back as the early half of the eighteenth century. These mills are almost always situated near the bank of one of the numerous mountain rivers, on the flat *pampa* where an easily accessible and fairly constant supply of water may be assured. Water is used entirely, in and around the Cerro de Pasco district, as motive power for driving the mills, and of course water is necessary in the amalgamation process.

Source of the Ores

The mill which is herein described is about four miles west of La Fundicion, the site of the smeltery of the Cerro de Pasco Mining Company, and about six miles south of Cerro de Pasco. The mines of that town supply practically all of the ore treated at the mills in the district. These are surface ores, of a rather highly oxidized, silicious nature, the silver generally occurring in the form of native silver or as a sulphide. They are broken moderately fine in the mining, seldom containing pieces of more than two or three inches diameter. They are sacked at the mines at Cerro de Pasco and carried upon the backs of llamas, to the mill, where they are piled in close proximity to the grinding wheels.

Construction of the Stone Mills

The chilean mill consists of a simple, yet rather ingenious, combination of two large stones of flat, cylindrical shape. One stone is used as a base, lying flat upon the ground; the other, revolving upon its perimeter on the base stone, acts as a grinding wheel. These stones are of one solid piece of fine-grained granite. They are cut from the granite ledges in the hills, sometimes several miles distant, and have to be rolled and dragged at the expenditure of much labor to the place of operation. The grinding wheel and the base stone are of the same size and shape, being cut to a diameter of seven feet and a thickness of 15 in. They weigh about four tons each. The only difference in the two stones is in the way they are cut out in the center. The base stone has a round hole 16 in. diameter cut in it, through which the vertical driving shaft, connecting the waterwheel and the grinding stone, passes. The grinding stone has a square hole 12x12-in. cut in it, into which the horizontal connecting shaft is fastened.

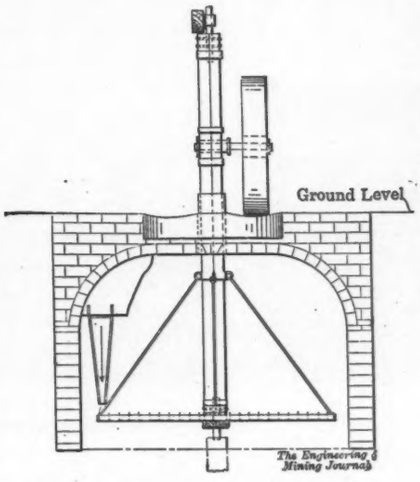


Fig. 1. Chilean Mill in Peru

The average life of a pair of these stones, as nearly as could be ascertained, is about one year. In one instance, a grinder and a base stone were worn down 14 in. and 7 in., respectively, during seven months of fairly constant usage. When well placed and securely fastened, so as to allow an even motion, these stones wear uniformly.

In case a stone is cracked in the cutting or while in use, it is repaired in such a way as to make the stone practically as good as new. This is done by first placing two strips of ½-in. iron, about 30 in. long and 2 in. wide, at right angles to the crack, one on each side of the stone. The strips are then securely bolted together through holes previously drilled in the stone. Then at two points along the line of the crack, one above and one below the iron strip, are placed two ¾-in. rods. These rods are about 30 in. long, and at each end three inches of the length is bent at right angles and sharpened. The sharpened ends are driven into holes in the stone, which have been drilled just a fraction of an inch less in diameter than the rod. These rods are usually placed on both sides of the stone.

The grinding stone is attached to the main shaft as shown in Fig. 1. The connecting shaft is a 4x4-in. timber, wedged into the square hole in the grinder. This timber is turned at the other end, and fitted with a brass ring, which works in a square brass boxing. The boxing is fitted into a rectangular opening in the main shaft, about three feet long. When the wheel is new, the boxing is near the top of the opening, and, as the wheel wears, the boxing gradually lowers in position, until it reaches the lowest point. When reaching this point, the old stones have to be replaced.

The main shaft is made up of two 7x7-in. timbers, bolted and banded together. Into the upper end of these timbers a round iron rod of 2 in. diameter is driven and bolted through. This rod turns in a plain ring bearing fastened to a 7x7-in. cross-timber about 10 ft. above the ground. The driving shaft extends down through the hole in the base stone into an underground room, 14 ft. square by 10 ft. high, built entirely of stone.

Mills Driven by Waterwheels

At the lower extremity of the shaft is the waterwheel. This is a horizontal wheel (many vertical wheels are also found in this district), of 12 ft. diameter, made of two concentric wooden rings, seven inches apart, into which 9x5-in. iron vanes are placed, with a spacing of six inches. The wheel is fastened to the shaft by four 4x8-in. timbers, extending from the shaft to the wheel perimeter, laid two and two at right angles. There are also four ⅝-in. iron suspension rods extending from the perimeter of the wheel to rings in an iron band around the shaft, six feet above the wheel. The water strikes the wheel in a three-inch stream, on a line tangent with the inner ring, thus causing no side thrust against the shaft.

The Lay-out for the Patio Process

As this mill is situated almost directly on the banks of a fair-sized stream, a constant water supply may be had any time of the year. This water is distributed to the patios and chilean mill by means of a well built ditch, which takes its

water from a point upstream. The ditch circles two sides of the whole series of patios, extends along a line about 20 ft. above the chilean mill, and finally overflows at a point where the water drains back to the river again. At two points along one portion of the ditch, shown as (1) and (2) in Fig. 2, there are breaks provided, where water may be taken out for use in the patios. When water is not needed at these points, the breaks in the bank of the ditch are dammed with mud and stones. This method of controlling the water supply from the ditch to the various points where it is used, is general, and seldom will one see any artificial device for this purpose. The one exception is at the point where water is taken from the ditch for driving the waterwheel, for here the volume of outflowing water is too great to be readily stopped in the manner mentioned. At the lower end of the ditch is a wooden lift gate which controls the amount of water going to the waterwheel. This water gets a fall of about 15 ft. in a tapering wooden trough, between the take-off from the main ditch and the waterwheel. Between 100 and 125 cu.ft. of water per min. are necessary to drive the wheel. At a point a few feet above the main take-off is a small break in the bank of the ditch, connecting with a small shallow ditch, through which water is supplied to the mill.

Method of Grinding the Ore

The ore is handled by shovels from the ore heap to the mill, and a constantly small supply of water aids in the grinding. The grinding wheel averages about 12 r.p.m., being varied at the will of the operator. The base stone is surrounded by a bank of stones and earth, to the hight of about a foot above the ground level, except at the point where the water and finely ground ore leave the mill. An iron ring, extending about one foot from the base stone, is fitted into the central hole of this stone, preventing the milled ore from being washed below. One mill will grind between seven and ten tons of ore in 24 hours. The milled ore will pass a 60- or 80-mesh screen.

There are two points at which the milled ore and water may leave the mill, as shown in Fig. 2, only one being used at a time, however. The ore is delivered either directly to the patios, Nos. 1, 2 or 3, or to one of the three settling tanks.

The patios are about 35 ft. diameter. Their walls are of stone, about 5 ft. high and 3 ft. thick; the bottoms are entirely stone lined. In the center of each patio is a driver's stand of stone, about 3 ft. diameter and of equal hight, upon which a man may stand and drive his animals during the process of amalgamation. A patio is considered filled when the ore reaches a depth of about one foot over its entire surface, equivalent to 60 or 70 tons of ore. To fill one patio requires seven 24-hour days of constant grinding at the mill.

Patios Nos. 1, 2 and 3, Fig. 2, receive their ore supply through opening *P* in each case. At *Z* is shown the main delivery ditch dammed, the ore running through a side trough into patio No. 2. In case the first three patios are filled, the ore is run through the second delivery ditch into the settling tanks. These tanks are really stone-lined excavations, 8 ft. wide, 6 ft. deep, and respectively 25, 40, and 25 ft. long. Here the ore is allowed to settle, and most of the water is drawn off. The wet ore is then carried in large buckets upon the shoulders of the Cholo laborers to one of the last six patios, where it is ready for amalgamation.

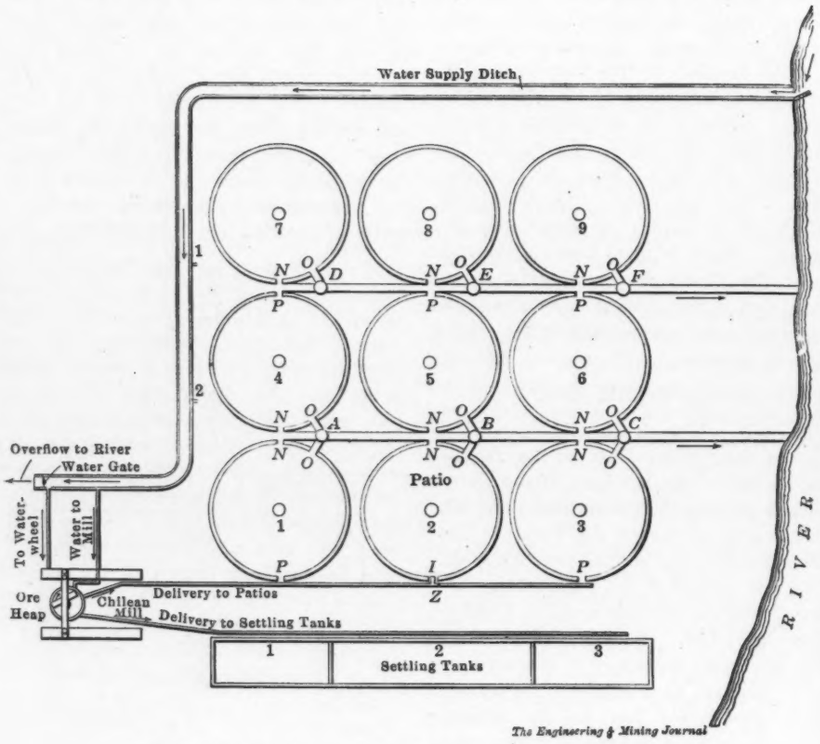


FIG. 2. LAYOUT OF A PATIO NEAR CERRO DE PASCO, PERU

Treatment in the Patios

After the patio is filled all the outlets are dammed. The ore is allowed to stand until enough of the water evaporates to leave the ore of a consistency of a moderately thin mud. Then 300 lb. of quicksilver, 400 lb. of salt and 200 lb. of copper sulphate are added, these, of course, varying with the richness of the ores. The mercury used in this district is mostly of local origin. The reactions taking place between these constituents for amalgamation may be expressed, according to Egleston, by the following equations:

(1) $CuSO_4 + 2NaCl = CuCl_2 + Na_2SO_4$.

(2) $2Ag + 2CuCl_2 = 2AgCl + Cu_2Cl_2$.

(3) $Ag_2S + CuCl_2 = 2AgCl + CuS$.

(4) $2AgCl + 2Hg = HgCl_2 + Ag_2Hg$.

A number of horses, usually eight or 10, are used for mixing the ores during amalgamation. In some places where horses cannot be obtained for this purpose, men do the mixing by walking in the patio. The amalgamation process extends over a period of many days, the progress being kept track of by a close observation of the mercury obtained by washing some of the pulp in a shallow pan. When it is considered that all the silver is amalgamated a small stream of water is admitted at the opening *N*, Fig 2, and the dam is partially broken down at *O*. The horses are again driven around in the patio, this time to wash out all the earthy material, allowing the heavier mercury and amalgam to settle naturally to the bottom. At first the slimes alone are washed over the dam at *O*, but soon the dam is lowered, and the sands too are washed out. All of the material leaving the patio goes first to a settling pit *A*, 2 ft. in diameter by 2 ft. deep, which is made of stones, carefully laid. In this pit much of the amalgam, escaping from the patio, collects, and may readily be recovered at short intervals. These pits are cleaned out by means of a scoop-shaped hoe. All waste water and tailings from the

patio run down a long, stone-lined ditch to the river. At certain points along these ditches, shallow rectangular pits are made, which are supposed to prevent the last traces of any amalgam being washed away. Such is, however, not the case, for, with the crude methods, much amalgam and metallic mercury must escape with the tailings. When the last of the tailings have been washed from the patio, the bottom is carefully scraped and the amalgam collected in large, hide bags. These bags are placed in great iron receptacles, and the excess mercury is pressed out by means of heavy weights.

Retorting the Amalgam

A small retort furnace built of stone and brick is used for the recovery of the mercury and silver bullion from the amalgam. There is a small grate, 18x12 in., in an arched firebox, 3x1 ft. by 15 in. high. The heat is drawn straight back around the sides of a cylindrically shaped iron retort, by means of a draft through a stone stack about four feet square and 12 ft. high. The iron retort is set in a four-legged iron stand, which, in turn, stands in a large wooden box, partially filled with water. There is a cylindrical iron hood suspended from an overhead beam, which completely covers the retort and its stand, and the lower end of which is submerged in the water in the wooden box. This hood may be raised and lowered by a rope and crude wooden pulley. The mercury, upon becoming volatilized, leaves the retort, is deflected downward by the hood and condenses upon striking the water. After all the mercury in the retort has been volatilized, the hood is raised and the silver bullion is recovered from the retort. The mercury is recovered from the wooden box, and is used again in the patio.

In this method for the recovery of silver from its ores, we can still see one of the most primitive forms of milling that has ever been practised, and one which is quickly becoming extinct, even in these still primitive parts of the world. As far as being practised on a commercial scale, this process has long since given place to others, but even today one can find a man here and there in these mountains who, at certain seasons of the year, will clean his patios, repair his mill and once more resume the operations of a past generation.

A New Electric Steel Process

Steel refined by a new electrical process is used[1] for making castings in the foundry of Le Gallais, Metz & Co., Dommeldingen, Germany. The steel is made from molten basic pig iron obtained from the company's blast furnaces. It is treated first in a tilting openhearth furnace of 20 tons capacity, which is fired by producer gas generated by two producers, 5½ ft. in diameter and 10½ ft. high. The finished product of the openhearth furnace is a mild steel containing about 0.45 phosphorus, 0.40 sulphur, 0.15 carbon, 0.25 per cent. manganese and traces of silicon.

A charge consisting of 3½ tons of steel is transferred from the openhearth to the electric furnace and a new addition of that amount of molten basic iron is charged into the openhearth furnace. This addition is made to the openhearth charge immediately after each electric furnace charge is tapped out, and the process is, therefore, practically continuous, four electric furnaces being in use. The foundry produces castings up to 10 tons in weight, and the tensile strength of the steel will vary from 51,000 to 64,000 lb. per square inch, with an elongation of 25 per cent. to 85,000 or 90,000 lb. per square inch with 8 to 10 per cent. elongation. A special mild steel is made for castings for electrical purposes, which has approximately the following composition: Carbon, 0.05 to 0.06; manganese, 0.20; phosphorus, 0.005, and sulphur, 0.003 per cent.

[1]Abstract from the Cleveland *Iron Trade Review*, Oct. 26, 1911.

A Method of Underhand Stoping

By George A. Laird*

With the recent progress in the top-slicing, cave-stoping and square-set methods of mining but little attention has been given to the old and apparently poor practice of underhand stoping, which, while admittedly not as satisfactory as it might be, is nevertheless at times the only practical manner of mining the ore. This is, or has been, the case at the Leon mines, of the Candelaria Mining Company, as the available ore has been confined to the region above the water level, this level being lowered too slowly, in spite of heavy pumping equipment, to make it possible to attack the ore from below.

The orebodies consist of lead carbonates, lying between a limestone hanging and a soft, porphyry, foot wall, the angle of both walls varying from horizontal to perpendicular. The shoots are of large dimensions, frequently reaching widths of 40 ft. or more. When the deposits stand vertically, the foot wall sloughs to such an extent as to be dangerous, to say nothing of its causing trouble by mixing with the ore. Various methods have

*Manager, Candelaria Mining Company, Minas de San Pedro, Chihuahua, Mex.

Fig. 1. Incline in a Stope at the Leon Mines

Fig. 2. Bridge Sets Supported by Posts

been tried for supporting it. As the water level, frequently several inches above the working floor, limits the point of stoping operations, the work has been most satisfactorily done by working to this level at the time the stoping cut is first made. In the Bonanza stope the following program has been followed:

The orebody, several hundred feet in length, has an average width of 22 ft., with a maximum of 60 ft., which width, however, is of but slight extent, and has been of little or no moment in the general work. The widest part of the stope is 100 ft. in length, with an average width of 33 ft. It is nearly perpendicular, and the foot wall crumbles easily.

An incline was sunk in the ore, parallel with the strike, at an angle of approximately 30 deg. from the horizontal, and a winch was installed for hoisting and lowering the tram cars as shown in Fig. 1. This incline was cut to the water level, and as soon as water was encountered a large turn-sheet was placed at the bottom for handling the cars, which were run in all directions on tracks. The tracks were made into rail-length sections, so that they could be taken apart readily and be moved from place to place as necessity demanded.

As the floor was lowered, the "bridge sets" shown in Figs. 2 and 3 were installed, the lagging being held in place by wedges or blocks bolted to the stringers and driven from above as depth was gained or necessity demanded. The tops of the sets are entirely open, as the back of limestone is perfectly secure or is supported by stulls. At the bottom of the incline, limestone cut off the line of the incline, so a vertical pit was sunk and a cage installed. This cage runs in balance, a piece of 14-in. pipe filled with scrap iron being used to counterbalance the weight of the cage and an empty car. Hoisting is rapid and economical, and the same method of handling the ore as at the foot of the incline is used. The guides are supported from the bridge sets, and no regard is paid to the size of the pit, its alinement or the amount of material it produces, as it is all ore.

No center distances between sets is fixed, as the timbers are put in as often as is necessary, but once started the line is carried through the stope. The sets shown in the illustrations are from four to six feet centers, vertically, and from five to eight feet centers horizontally. The lowest sets are usually held by posts set on the floor, which are thrown out of alinement or taken out completely to make room for the next set, as shown in Fig. 2 in the right foreground.

The amount of timber used is nominal, and as yet not a single set has caused trouble. The work has been done under the direction of Maximo Avalos, the mine superintendent, who is responsible for its design. While every pound of ore broken must be shoveled, the breaking costs, breaking to a floor, are by no means as high as the general underhand-stoping costs are supposed to be when compared to back stoping in square-set ground; 3¼-in. Sullivan drills are used, and heavy shooting, with care in pointing the holes, has caused no material damage. Perhaps this method of timbering would not serve in heavy ground that was inclined to work; the ground in question, when dry, crumbles and sloughs to such an extent as to make the easing of the lagging advisable, yet not a single lagging has given way and the waste in the ore has been satisfactorily overcome. In Fig. 5 is shown the foot of the incline below the point shown in Fig. 4, and before the platform was installed. It also shows the manner of sustaining the limestone backs where the ore has run out almost horizontally from the main orebody.

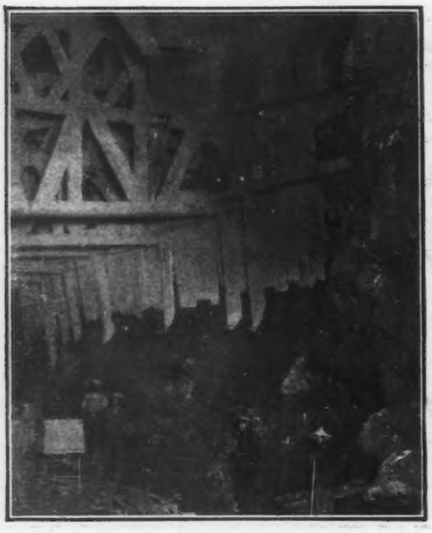


FIG. 3. TIMBERED STOPE

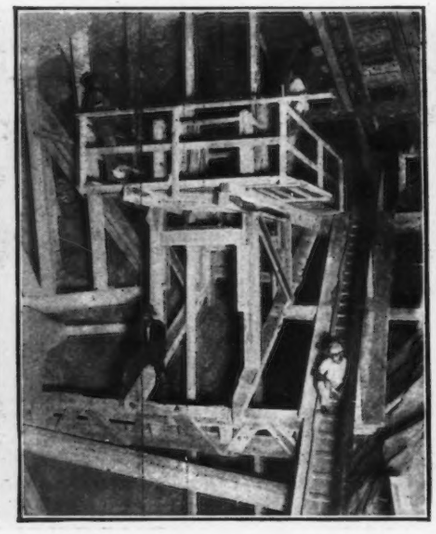


FIG. 4. BOTTOM OF INCLINE

FIG. 5. BOTTOM OF SHAFT

Michigan Mine Accidents

Reports at hand from the mine inspectors of Marquette and Dickinson counties, Michigan, offer an interesting comparison. The counties adjoin and are both situated in the iron district of the Upper Peninsula. In the former county, during the year ended Sept. 30, 1911, there occurred 32 fatal accidents distributed among 16 mines. As against this there were three fatal accidents in Dickinson county, during the same period, and 20 mines were operating. Interesting in connection with the latter is the fact that in this county the total number of persons employed underground and on surface was 2683. This means 1.12 fatal accidents per 1000 men employed. The total tons of ore mined were 1,753,174, and the number of tons mined per fatal accident was 584,391.

In Dickinson county, one man was crushed by a chunk of ore, another was suffocated by fine ore, and the third fell and fractured his spine. In Marquette county one man was killed in each of the following ways: By falling from skip, falling from cage, coming in contact with machinery, breaking of timber, dirt rolling from railroad car, breaking of friction-band bolt, loose dirt, falling down stairway, falling in raise and by being run over by a railroad car; five were struck in a shaft by a crosshead; six were caught in a fall of ground; three fell down shafts and eight were killed by gas and smoke. Fourteen of these were due to causes which have never before been responsible for mine accidents in the county, namely, the crosshead, fire and railroad accidents. Considering the length of time that mining has been in operation in that field, it is noteworthy that these accidents, two of which, at least, are of quite common occurrence, should have appeared for the first time in the records of the county.

The Genesis of Ore Deposits—II

By E. K. Soper*

Certain deposits are clearly due to contact metamorphism. Most large and rich ore deposits are workable because of secondary enrichment.

*University of Minnesota, Minneapolis, Minn.

Under contact metamorphic deposits are included certain orebodies found in sedimentary rocks near the contact with an igneous intrusive. The sedimentary is usually of a calcareous nature—limestone and calcareous shales being the commonest—while the igneous rock is more often acidic than basic. This type of deposit should be distinguished from simple contact deposits, which refer to any ore deposits at the contact of igneous and other rocks, regardless of the precise manner in which the minerals were deposited.

Theory of Contact Metamorphic Deposits

The theory commonly accepted in explanation of the formation of contact metamorphic deposits is that the process is essentially one of mineralization contemporaneous with the metamorphism of the sediments by the intrusive. As pointed out, magmas give off watery vapors while cooling, and this vapor is probably heated above its critical temperature (365 deg. C.) and is under considerable pressure. The presence of certain minerals, such as fluorine and boron compounds, which are found in these deposits, is evidence that these elements are also present in a gaseous state during the cooling of the magma. Furthermore, certain metals and silica are usually present and the former may combine with fluorine or boron to form highly volatile compounds.

Assuming that the sedimentary rock is a limestone (which is nearly always the case) the gases and vapors of the magma, together with the steam generated, are forced into the pores and fissures of the limestone, permeating the entire mass adjacent to the intrusive and replacing it, molecule by molecule. If silica, alumina, or iron be present, they will combine with the lime to form epidote, garnet, etc., and the presence of these minerals is one of the chief criteria for the recognition of a deposit of this class. Finally, any metals which may be present are deposited, also by replacement of the limestone, in the zone of intense metamorphism.

Thus, new minerals are formed in the sedimentary rock close to the intrusive. Formerly it was thought that these new minerals were due to a recrystallization of the impurities in the sediments rather than to the introduction of any additional material by the intrusive. But recent investigations of deposits of this type, as well as analyses made of the unaltered limestone and also of its metamorphosed equivalent, have shown the fallacy of this theory. Many elements were found to be present in the metamorphosed zone which were entirely lacking in the original unaltered rock.

Thus, ore deposits may be formed in an exceedingly pure limestone, the valuable minerals being introduced by the intruding magma. When the sedimentary rock is shaly, or an extremely impure variety of limestone, recrystallization would doubtless result in the formation of garnets and other silicates. In such a case, the result would be a rock containing new minerals due to both recrystallization of the original, and addition of new material. Compounds of fluorine, etc., in a mobile state, have the power to dissolve metals with which they may come in contact during their progress through the rock, and thus we have an additional cause for the concentration of ore minerals.

The Principal Minerals

The most important ore minerals occurring as deposits of this class are pyrite, chalcopyrite and magnetite, while bornite, pyrrhotite, specularite, sphalerite and galena are occasionally met with. The characteristic gangue minerals are garnet, epidote, diopside, tremolite, actinolite and wollastonite. Copper and iron ores form the chief workable deposits, but zinc and lead are known to occur in sufficient quantities to mine.

Contact metamorphic deposits seem to follow no definite rule regarding shape and size, or place in the sediments. In a general way, however, their position is largely determined by the porosity and amount of fissuring of the rocks. Certain deposits seem to favor the shaly layers in limestone, but others are known in comparatively pure rocks. In all cases, the substances entering the limestone are confined to areas adjoining the intrusive, and they are rarely found at distances greater that 2000 ft. from the contacts; although the effects of contact metamorphism may extend, according to Vogt, as far as a mile from the intrusive. Associated with the contact-metamorphic ores are often found deposits of other types and even of different metallic content. These may be either disseminated orebodies or veins. Igneous intrusions do not always bring about metamorphism of the sediments, and even where such alteration does occur accompanied by a deposition of metallic minerals, the resulting deposit usually requires a secondary concentration before workable orebodies are formed.

Secondary Enrichment

Many ore deposits contain rich belts in their upper parts, and a gradual diminution of value occurs as the depth increases. The topmost portion of these deposits has usually undergone both chemical and physical changes, due to weathering, and this altered zone sometimes extends to considerable depth. In the weathered portion the metallic content may be small, but from the groundwater level down to a variable depth, secondary processes have often brought about enrichment. Finally, as the depth increases, the primary sulphide ores are encountered and a marked falling off in values is the usual result.

These conditions cannot be explained as the work of ascending waters alone, nor are they satisfactorily explained by descending waters. They may be fully explained, however, as the work of both ascending and descending waters. An ore deposit may be divided theoretically into three vertical zones:

I. (a) Zone near the outcrop. Dominating feature is leaching of soluble minerals, preceded by oxidation. (b) Lower horizon, still in zone of oxidation. Deposition here of metals as native, oxides and carbonates. II. Upper horizon of sulphide zone; at level of ground water and below it. Controlling feature is enrichment due to secondary deposition as sulphides. III. Region below—primary ore, usually leaner. These zones are not sharply defined and may grade imperceptibly into each other, causing an overlap of some minerals from one zone into the next.

Ascending waters, either meteoric or magmatic, may produce the first concentration of ore minerals. A second concentration by descending waters then occurs, making rich deposits. These rich deposits are usually found within the first thousand feet, but may extend deeper. This action may, therefore, produce a rich deposit from one that was originally lean and disseminated through the country rock.

During the process of decay and disintegration of the upper portions of ore deposits by weathering, the chemical reactions involved may be numerous and intricate, due to the presence of a great variety of different minerals, many of which may have a metallic base.

The different horizons mentioned above are, therefore, distinguished by certain characteristic compounds. In the weath-

ered zone carbonates, sulphates, oxides, silicates, chlorides, arsenates and native metals prodominate. Below this region sulphides, arsenides, antimonides and tellurides may be encountered. These primary minerals are commonly pyrite, marcasite, pyrrhotite, arsenopyrite, galena, sphalerite, chalcopyrite and other copper sulphides. The combination of minerals found in any one deposit will vary greatly, but certain minerals are more often associated together than others. For instance, the association of primary compounds of lead, zinc and iron; copper and iron; silver and lead; or gold and silver is well known.

Surface Indications of Deposits

The physical and chemical changes that occur near the surface may completely obscure the true nature of the deposit. At Bingham, Utah, and Ely, Nevada, the material worked at the outcrop was a gold-bearing ore, but in depth this gave place to immense bodies of copper or lead sulphides. Again, the metallic content of the portion of the deposit near the surface may be more or less completely leached out and redeposited lower down, leaving the outcrop quite barren. It is, therefore, necessary that the prospector be able to recognize any changes or indications that may be present in such leached zones, which will furnish a clue to possible deposits of value beneath. One of the commonest results of this process of leaching of the outcrop is the porous condition of the rock and the deep brown stain due to the formation of limonite. This strongly stained covering of the deposite is called the gossan or "iron hat," and many important orebodies, especially certain copper deposits, show only such a gossan at the surface.

The weathering of the metalliferous minerals will, in general, proceed more rapidly than in the case of the common rock forming minerals. This results in the alteration of the orebody to a greater depth than that of the surrounding rock. The depth of weathering also depends largely on climatic and topographic conditions, and the porosity of the rocks. In regions of rapid erosion the primary ore is found near the surface for the altered zone is removed as fast as the changes occur. Flat, or arid regions present the other extreme. Here denudation lags behind alteration, with the result that the oxidized zone may extend to considerable depth, as at Bisbee, Arizona, where oxide orebodies occur at 700 ft. below the surface.

Just below the limit of oxidation there is often found a greatly enriched zone of secondary sulphides, and this is especially true in the case of gold, silver, copper, lead and zinc ores. This concentration of metals near the surface is due to repeated migration downward as weathering and denudation proceed. The result of this is the rearrangement of the horizontal sequence of minerals, so that the different metals become more or less segregated into zones, as the depth increases. For instance, zinc, iron and lead sulphides are soluble in the order given. Therefore, they will precipitate in the reverse order, so that the lead becomes concentrated nearest the surface in the oxidized zone. Copper is easily soluble and easily precipitated. Therefore, copper deposits usually show a marked impoverishment near the surface.

Silver usually occurs in association with lead, copper, gold or iron. As these deposits become weathered, the silver lags behind, due to the fact that it resists oxidation more than the others. This explains the finding of bonanzas in the upper levels of certain deposits of this type. Gold offers great resistance to solubility, but the upper portions of gold-bearing orebodies may become enriched by mechanical action, or by the removal of the more soluble gangue minerals. The chemical reactions involved in processes of secondary concentration may best be understood by considering several individual districts.

Typical Lead-zinc Deposit

The lead-zinc region of the upper Mississippi valley will serve as a typical example to illustrate the processes in the secondary alteration of the ores of these metals. Here the lead and zinc minerals are associated with marcasite, pyrite and chalcopyrite, and occur in limestones. The order of mineral occurrence in the district is: (1) Belt of weathering above ground-water level, galena and smithsonite. The galena is often incrusted with cerussite and anglesite. Some sphalerite occurs with the smithsonite. (2) Below the level of ground water the oxidized products disappear and sphalerite is the chief mineral.

The first concentration, probably by ascending waters, resulted in the formation of the sulphides of lead, zinc and iron. It has already been shown how a second concentration could be the result of descending waters, and how the sulphides above the ground-water level would become oxidized. But it is necessary to explain how descending waters could concentrate the galena at high levels and the sphalerite lower. Assuming that the sulphides from the first concentration by ascending waters were evenly distributed, the galena might be gradually concentrated at the top because of the difficulty with which it oxidizes. The oxidation, solution and downward migration of the sphalerite and marcasite would explain the concentration of the lead at higher levels. The oxidation of lead-silver ores is well shown at Leadville, Colo., and Santa Eulalia, Mexico, where the chief influencing factors have been the soluble nature of the country rock, the climate and slow erosion. The alteration of the primary sulphides to carbonate ore, rich in silver, has resulted in extensive masses of great value.

Occurrence of Copper Minerals

Chalcopyrite is usually the original copper mineral, but not necessarily, for it may be of secondary origin. The general order of occurrence of copper minerals is: (1) Above level of ground water: Cuprite, azurite, malachite and other oxidized products. (2) Below level of ground water: Chalcocite, bornite, chalcopyrite, covellite.

Carbonates and oxides are not found far below the ground-water level. The richer copper sulphides are confined to the upper zone of ground water and the chalcopyrite gradually gives way to pyrite as the depth increases. Whatever alteration has taken place, the zone of enriched sulphides is usually well developed. Chalcopyrite usually predominates in the silicate rocks and porphyry, while the oxidized products are more often found in porous or soluble rocks, such as sandstone or limestone. At the greatest depth there would probably be found cupriferous pyrite as a result of a first concentration by ascending solutions. As these solutions rose, they may have encountered some oxygen from above, which would unite with iron. Above this, solutions moving downward, containing copper sulphate, may have been met with, resulting in a precipitation of chalcopyrite according to the reactions:[15]

$$CuSO_4 + 2\,FeS = CuFeS_2 + FeSO_4$$

$$CuSO_4 + 2\,FeS_2 + O_4 = CuFeS_2 + FeSO_4 + 2\,SO_2.$$

Passing upward the chalcopyrite will steadily increase in amount until a point is reached where the iron sulphide becomes subordinate. Here bornite will probably occur, due to the reaction:

$$Cu_2SO_4 + CuSO_4 + 3\,FeS = Cu_3FeS_3 + 2\,FeSO_4$$

$$2\,CuFeS_2 + CuSO_4 + O_2 = Cu_3FeS_3 + FeSO_4 + SO_2.$$

Still higher, chalcocite may appear. When a point is reached where all the sulphides have been exposed to oxidation by CO_2 and O, the carbonates and oxides will predominate. Finally, above this zone, there remains the leached surface which furnished the copper sulphate which played an important part in the precipitation of the rich sulphides below.

Alteration of Silver Ores

Rich silver compounds, such as cerargyrite, pyrargyrite, argentite, proustite, stephanite and native silver are likely to be abundant in the upper levels of mines, and almost disappear as depth obtains, giving place to argentiferous lead, zinc or copper minerals. Since the silver supply of the world comes chiefly from silver-gold, silver-lead, or silver-cobalt ores,

[15]Van Hise, "Some Principles Controlling the Deposition of Ores," *Trans.* A. I. M. E., Vol. 30, p. 111.

the processes of secondary alteration of silver ores are essentially the same as those which alter its base-metal associates. Secondary silver ores are most characteristic of arid regions, such as at Broken Hill or Mexico. In the case of lead-zinc-silver deposits, as the ore gets poorer in lead and zinc, it is likely to get poorer in silver also. The same holds true for argentiferous copper ores.

Silver holds to its sulphur stronger than do the base metals. Therefore the first-base metal met in mass by silver-bearing solutions will be reacted upon by silver salts, thus:

$$Cu_2S + Ag_2SO_4 = Ag_2S + Cu_2SO_4$$
$$Cu_2S + 2AgCl = Ag_2S + 2CuCl$$

giving argentite in either case. In general, then, the silver which is rendered soluble by oxidation, is carried below, where it reacts with the baser metals and is concentrated in the upper portions of the deposit as an independent silver sulphide, or as a silver sulphide associated with rich sulphides of the base metals.

Gold Occurrence

Gold occurs native and associated with sulphides or tellurides. Pyrite is probably the commonest associate. In the weathered portion of ore deposits, the gold is usually native or associated with oxidized products of other metals. The superficial alteration of these deposits leaves the gold behind in the native state and often renders it coarser. While such a concentration has taken place in many deposits and made possible their original discovery, it is nevertheless true that the great gold mines of the world do not owe their value to the enriched portion of the ore near the surface, but rather to the persistence of the primary ore in depth. This primary ore is probably deposited from solution in the same general manner as the ores of other metals.

Gold is soluble in alkaline solutions, especially in solutions of alkaline sulphides. It also combines readily with iodine and chlorine, and as an iodide or chloride is quite soluble. Gold is also soluble in ferric sulphate. The precipitation of the gold may be readily brought about by organic matter, or by any "ous" salt. The gold as originally precipitated is usually in the native state, but intimately associated with the sulphides. Probably the same conditions that produce the sulphides cause the precipitation of gold. After a first concentration has been brought about, there may be a second, due to the leaching of the weathered zone and consequent enrichment of the residual gold. Portions of this gold may be dissolved and carried below to be reprecipitated with secondary sulphides, in much the same manner as copper.

Manganese Causes Alterations

A valuable contribution to the study of the secondary enrichment of ore deposits by William H. Emmons[16], has recently been published in which new light is thrown on the problem of superficial alteration of gold deposits, and the important role of manganese in the alteration process. It is well known that nascent chlorine is one of the best solvents for gold, and, therefore, deposits exposed to the strong action of this element are likely to show considerable alteration. However, nascent chlorine is not produced in mineral waters except under certain conditions, even though chlorine compounds be present in the rocks in considerable amount.

Mr. Emmons' observations on the gold deposits in the Western States show that manganese is of great importance in the alteration of gold deposits, by reason of its power to liberate nascent chlorine from NaCl in cold dilute solutions. Ferric iron, cupric copper and manganic manganese are present in many mineral waters and under the conditions of heat and pressure they all liberate free chlorine from NaCl, in acid solutions, and this nascent chlorine may then dissolve gold. But mine waters are cold and dilute, and in cold dilute solutions ferric iron will not give nascent chlorine in appreciable quantities. It is just here that manganese plays its important part, for manganic compounds release chlorine readily in cold dilute solutions, and in descending mine waters enrichment is thus brought about.

The gold dissolved by chlorine is precipitated by ferrous sulphate ($FeSO_4$). Ferric sulphate, $Fe_2(SO_4)_3$, does not precipitate gold. Primary ores generally contain pyrite which oxidizes at or near the surface to ferric sulphate, ferrous sulphate and sulphuric acid. Gold in solution, migrating downward, and meeting ferrous sulphate would immediately be precipitated and hence it would be natural to suppose that gold solutions could not migrate far in rocks containing pyrite.

But MnO_2 and higher manganese oxides readily convert ferrous iron to ferric iron, which does not precipitate the gold. Thus manganese favors the alteration of gold deposits in two ways: (1) By aiding in the solution of gold, and (2) by preventing the early precipitation of the gold It is therefore probable that gold deposits, the gangues of which contain manganese, will show greater downward migration of the gold than in the case of nonmanganiferous deposits, and from this it might further be expected that nonmanganiferous gold deposits are more likely to form placers than are those in which manganese is lacking.

[16] *Bull.* A. I. M. E. October, 1910, "Manganese in the Secondary Enrichment of Gold Deposits of the United States."

Much of the gold, however, may remain behind and many deposits must depend for their value upon the richness of the primary auriferous pyrite or other sulphides which may predominate. H. C. Hoover[17], states that most gold mines of his knowledge grow poorer in depth below the upper zones.

Summary

In the foregoing pages an attempt has been made to describe in a general way, the tendencies in the study of ore deposits in the light of modern theory. The important points may be summarized as follows: Geologists are generally agreed that the primary source of the metals is the igneous rocks, and that valuable deposits are formed by a concentration of these metals, chiefly through the agency of watery solutions. The sources of these solutions are not so well understood, nor is the precise manner of solution and precipitation of the ores. Some maintain the waters carrying the metals in solution to be of meteoric origin, while others tend toward the belief that only a magmatic origin of the waters can explain the observed phenomena at most mines.

Certain types of ore deposits are clearly the result of contact or regional metamorphism, while others are due to solfataric action. Furthermore, most of the larger and richer ore deposits, whatever their origin, are only made workable by some process of secondary enrichment, which accomplishes a rearrangement of the minerals, into zones, which vary according to the chemical nature of the ores. Thus, we see that most ore deposits are the result of two or more concentrations from an original disseminated condition in the rocks. Lastly, there are certain superficial deposits (including placers and stream deposits) which are concentrations from weathered fragments derived from the disintegration of veins in place.

[17] "Principles of Mining," H. C. Hoover (1909), p. 29.

Alundum Crucibles

Crucibles made of alundum, a fused form of alumina, are reported to be in successful use for melting metals of high fusion point. L. E. Saunders reports (*Chem. Trade Journ.*, Sept. 9, 1911) that beside the usual white crystalline substance, which contains less than 1 per cent. of iron oxide and other impurities, there is a reddish-brown alundum, which contains 5 or 6 per cent. of impurities. This variety has a melting point of about 2050 deg. C., or much lower than that of the white. The purer variety has a specific gravity of 3.93 to 4, a heat conductivity of three or four times that of fire clay and resists the action of aqueous acid and alkali. The crucibles of alundum are too porous for melting slag.

Electrolytic Refining of Gold

By Edward B. Durham *

At the San Francisco mint, the refining of gold is carried on with a current density of 90 amp. per sq. ft., the electrolyte being a trichloride solution with 10 to 12 per cent. of free hydrochloric acid. Treatment of copper byproducts also outlined.

NOTE—Excerpts from a paper, "Electrolytic Refining at the United States Mint, San Francisco, Cal.," presented at the San Francisco meeting of the American Institute of Mining Engineers, October, 1911.

*Berkeley, Cal.

The process tree, Fig. 2, gives an outline in a graphic form of the process of gold refining as practised at the U. S. mint at San Francisco.

The anodes, of the same size as the silver ones shown previously, are made from high-grade gold bullion, and crude-gold products from both the gold- and the silver-refining processes. They carry about 90 per cent. of gold and it is desirable that the silver content be limited to about 7 per cent., since a greater amount interferes with the operations. Copper is less objectionable than silver. The metal for the anodes is melted in the furnaces similar to those used in the silver process. The anodes, hung by C-shaped hooks of pure gold from the conductors running across the top of the cells, are immersed 7.5 in. in the electrolyte.

FIG. 1. MELTING ROOM AT U. S. MINT, SAN FRANCISCO

GOLD CATHODES WILL NOT STRIP

The cathodes, strips of pure gold 4 in. wide by 0.012 in. thick (No. 28 B. & S. gage), weigh about 4.5 oz. They are bent over at the top, so that they can be hooked over the conductors crossing the top of the cells. They are immersed to a depth of 6 in., and are allowed to remain in the cells until they weigh about 160 oz., when they are removed and used as the anodes for the second set of cells. By this redeposition the fineness of the final product is raised to about 999.7. The gold is deposited on the cathodes so tightly that stripping is impracticable, and when the final cathodes have been formed, the deposit with its original cathode sheet is all melted down together. Hence, the original strips have to be made of pure gold in order to maintain the quality of the product.

The electrolyte is a trichloride solution, carrying in the first set of cells 70 grams of gold per liter, and from 10 to 12 per cent. of free hydrochloric acid, and in the second set, only 60 grams of gold per liter, but with the same amount of acid. During the operation, the electrolyte decomposes and drops particles of metallic gold, which collect in the slimes. This lowers the strength of the solution in gold, and when it gets below 4 per cent. of gold, the deposit on the cathode is soft and tends to crumble. To prevent this, the bath is tested daily to determine its strength in gold, and if found to be low, is restored to the desired standard by the addition of strong solution.

TESTING THE ELECTROLYTE

The test of the electrolyte for gold is made with ferrous-ammonium sulphate. A solution of this salt is made up of such strength that 1 cc. of it will precipitate 27.5 grams of gold. Then, to a liter of electrolyte is added 3.5 cc. of $Fe(NH_4)_2(SO_4)_2$ solution, which is capable of precipitating 96.25 grams of gold—more than the bath is likely to contain. The excess of the ferrous salt is then determined by titrating with potassium permanganate, using a solution such that 1 cc. of $K_2Mn_2O_8$ will oxidize 1 cc. of $Fe(NH_4)_2(SO_4)_2$. On dropping the permanganate into the solution, its purple color is destroyed as long as any of the ferrous salt remains, but when the latter is completely oxidized, an additional drop will retain its color, indicating the end of the reaction.

After a week, the electrolyte becomes spent and takes on a dirty dark green color, due to the accumulation of copper salts in the solution. When it reaches

this condition, the gold deposit on the cathodes is soft, and the electrolyte has to be changed.

The gold chloride for the electrolyte is made by dissolving gold bullion in hydrochloric acid by the aid of an electric current. Anodes of gold 990 fine are hung in strong hydrochloric acid, in five cells slightly larger than those used for the gold-refining process, and the cathodes, also of gold, are hung in porous cups filled with strong hydrochloric acid. On passing a current of 500 amp. at 25 volts through the cells, the anodes are dissolved, giving a solution of gold trichloride in the cells; but, owing to the porous cups, there is no gold deposited on the cathodes. Since hydrochloric-acid fumes are liberated in the process, it is performed under a glass-inclosed hood. The gold-chloride solution obtained from these cells has a strength of from 375 to 500 grams of gold per liter.

The Cells

The cells are of white royal Berlin porcelain. The electrolyte, like that in the silver cells, is kept in motion by one glass propeller in the center of each cell, revolved by a vertical glass rod. The cells are placed in two rows, of 14 each, on a long bench. Those on one side form the first set, and those on the other the second set, for retreating the cathodes formed in the first.

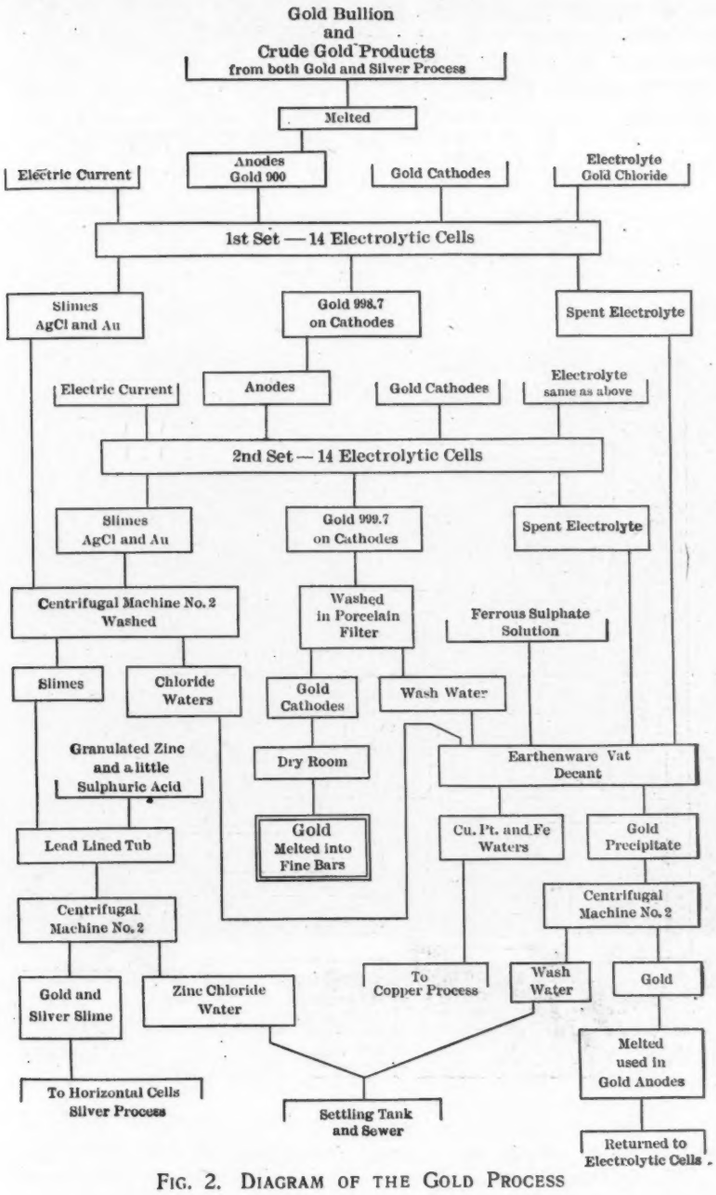


FIG. 2. DIAGRAM OF THE GOLD PROCESS

The space between adjacent cells is covered with a porcelain strip about 1x3 in. in cross-section, clamped to the rim of the cells, and having a series of notches to receive the porcelain bars which support the conductors across the tops of the cells from which the electrodes are hung.

There are three rows of anodes and four rows of cathodes in each cell. The rows of anodes alternate with the rows of cathodes, and are 2⅝ in. from center to center. There are two cathodes on each row, making eight cathodes per cell, and there are three anodes on each of two rows, but only two on the center row, making eight anodes per cell. The center anode is omitted to give room for the circulating propeller. The drive for the propellers is similar to that for the silver cells.

To the copper busbars, which are bolted to the top of the porcelain strips between the cells, are screwed the ends of the conductors that extend across the cells. These conductors are gold strips bent into an inverted-trough shape, and fit the top of the porcelain crossbars. The electrodes hang from these conductors.

Current Density 90 Amp. per Sq.Ft.

The current, a direct one of 15 volts, passes through the 14 cells of each set in series, requiring nearly 1 volt per cell. The total amount of current is 180 amp. There are eight cathodes in each cell in parallel, each having an immersed area of 4×6 in. $= 24$ sq.in. Four of the cathodes have both sides available for the reception of deposits and four have only one side available, thus making 12 cathode surfaces of 24 sq.in. each, or a total of 2 sq.ft. The current being 180 amp., the current density is 90 amp. per sq.ft. of cathode surface.

Centrifugal machine No. 2 is identical with No. 1, described under the silver process; but this one is used exclusively for gold products and material charged with chloride waters, which would precipitate silver chloride if it came in contact with solutions of silver salts. A different filter bag is used for each kind of material.

The drying room is of brick, has an iron door, is heated with steam and is built into one corner of the cell room. It is about 5x6 ft. It is used to dry fine gold cathodes and other gold products before charging them into the melting pots.

The vats used for the precipitation of the gold from the spent electrolyte are made of brown earthenware and stand on platform trucks for convenience in moving them about. They are 2x4 ft. in area, and 2 ft. deep. The tub used for the reduction of the silver chloride to metallic silver, by means of zinc and sulphuric acid, is made of wood and lined with lead. It is 2x4 ft., and 2 ft. deep, and mounted on a truck similar to the earthenware ones.

Briefly, the anodes are dissolved in the electrolyte and refined gold is deposited on the cathodes. All the metals in the anodes, including those of the platinum group, go into solution, except the silver and some lead. The last two form chlorides and drop to the bottom of the cells as the anodes dissolve. About 10 per cent. of the anodes is left as undissolved tops, and has to be remelted.

Composition of the Anodes

It is desirable that the anodes should not carry more than about 7 per cent. of silver. When more than this amount is present, the coating of silver chloride that forms on the anodes is thick enough to retard the dissolving action. When the anodes contain less than about 7 per cent. of silver, they can be treated in a single set of cells, and the gold deposit on the cathodes will be considerably over 999 fine. But when more than 7 per cent. is present, so much silver chloride is formed at the anodes that, in dropping off, some of it is caught by the circulating currents, and carried mechanically to the cathodes, where it clings to the rough surface of the gold deposit and lowers its fineness to less than 999. When handling such anodes high in silver, it has been found advisable to deposit the gold on the cathodes of one set of cells, and then transfer these cathodes, after washing them, to a second set of cells, where they are used as anodes and the gold is redeposited almost pure.

The gold anodes are made exclusively from the gold from the silver cells, which assays about 875 thousandths gold, from 100 to 125 thousandths silver and a small amount of base metals. This gives, in the first cells, cathodes about 998.7 fine, which, on being retreated in the second set of cells, produce gold about 999.7 fine. It has generally been considered necessary to boil the crude gold from the silver cells with concentrated sulphuric acid before casting it into anodes for the gold cells, in order to reduce the silver to less than 7 per cent. The desire to do away with this acid treatment, and still produce a high grade of gold deposit, led to the experiment of redepositing the first gold cathodes.

The same amount of current at the same voltage is used in both sets of cells. The electrolyte in the first set carries 70 grams, that of the second set 60 grams of gold per liter. With the exception of this difference in the strength of the electrolyte, the operation in both sets of cells is identical.

The gold cathodes from the second set of cells are carefully washed in a porcelain filter, dried in the dry room, melted and cast into fine bars about 1000 oz. in weight, which may be sold as "mint bars," or alloyed with copper and made into coins.

Electrolyte Changed When Copper Content Reaches 4 Per Cent.

The copper in the anodes goes into solution in the electrolyte; and as long as the proper amount of gold is maintained in the solution, it does no harm until the amount reaches about 4 per cent., when the gold begins to deposit soft and fall from the cathode. Then the electrolyte has to be changed.

The metals of the platinum group also dissolve in the electrolyte; and while they occur in such small quantities in the bullion that they can hardly be detected, the quantity accumulated in the solution by the dissolving of many anodes is quite appreciable, and is recovered as described later, under copper refining.

The silver in the anodes forms at the anodes insoluble silver chloride, a part of which, in the first set of cells, is removed at intervals by taking out the anodes and brushing and jarring off the silver chloride into an earthenware jar. Most of the silver chloride, however, drops to the bottom of the cells.

The slime in the bottom of the cells also contains metallic gold, which comes from the decomposition of the electrolyte, and does not deposit on the cathodes. This decomposition of the electrolyte seems to be due to the displacement of its gold by the copper dissolved from the anodes. In the first set of cells, with anodes containing 10 per cent. of silver, the slimes are about 600 thousandths gold and 300 thousandths silver, and in the second set, with anodes almost free from silver, they are 960 thousandths gold and only 40 thousandths silver.

Treatment of the Slime

The slime from the bottom of the cells, and the silver chloride that has been removed from the anodes, are washed free from soluble chlorides in centrifugal machine No. 2, using hot water in order to carry off the lead chloride, and are treated in a lead-lined tub with granulated zinc, which precipitates the silver in a metallic condition, the zinc becoming zinc chloride. The granulated zinc is stirred into the mass of silver chloride and a little sulphuric acid is added to start the reaction. At first, the wet slime is a gelatinous mass characteristic of silver chloride, but as the reaction progresses it becomes more and more gritty. The mixture is tested toward the end of the process for the presence of silver chloride, and when there is no longer any present, sufficient sulphuric acid is added to dissolve any zinc that remains.

The test for silver chloride is made by treating a sample of the slime with ammonium hydrate, and then adding a few drops of hydrochloric acid to the clear solution. If there should be any silver chloride present, it would be dissolved by the ammonia, and would reprecipitate on adding the hydrochloric acid.

The granular silver with its gold content, after being washed in centrifugal machine No. 2, to remove all soluble

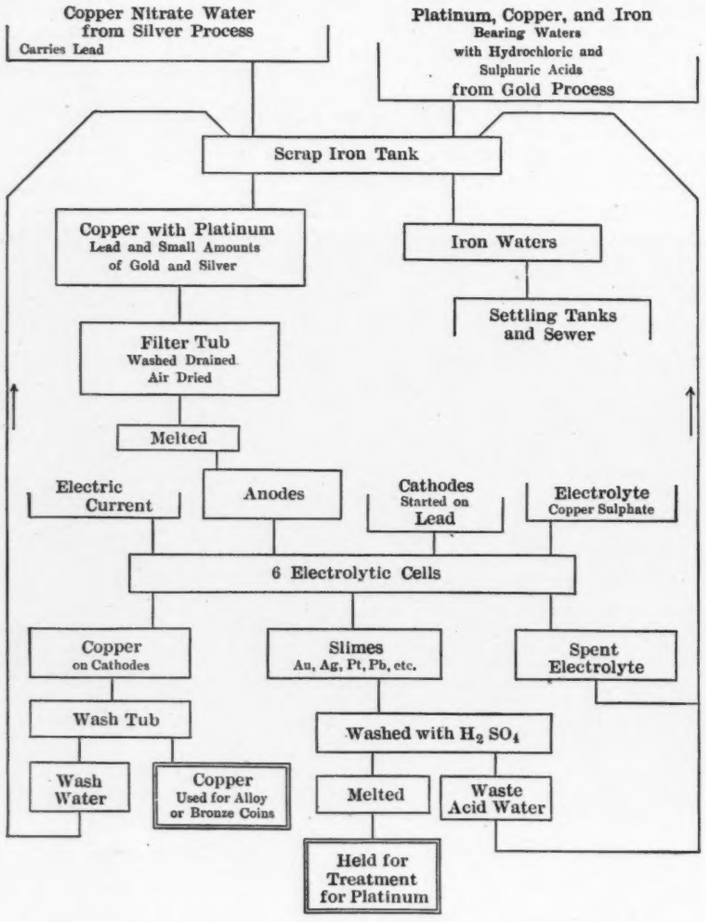

Copper Nitrate Water from Silver Process
Carries Lead
Platinum, Copper, and Iron Bearing Waters with Hydrochloric and Sulphuric Acids from Gold Process
Scrap Iron Tank
Copper with Platinum Lead and Small Amounts of Gold and Silver
Iron Waters
Settling Tanks and Sewer
Filter Tub Washed Drained Air Dried
Melted
Electric Current
Anodes
Cathodes Started on Lead
Electrolyte Copper Sulphate
6 Electrolytic Cells
Copper on Cathodes
Slimes Au, Ag, Pt, Pb, etc.
Spent Electrolyte
Wash Tub
Washed with H_2SO_4
Wash Water
Copper Used for Alloy or Bronze Coins
Melted
Waste Acid Water
Held for Treatment for Platinum

Fig. 3. Outline of Copper-refining Process

salts, is transferred to the anode basket of the horizontal cells of the silver process for the recovery of the silver; and the gold is afterward obtained from the basket residue.

The wash waters from the slimes and from the gold cathodes, together with the spent electrolyte from both sets of cells, are placed in earthenware vats, and a concentrated solution of ferrous sulphate is added to the liquid. This precipitates the gold, which is allowed to settle by long standing. The liquor, which still contains platinum, copper and iron salts, is decanted and sent to the scrap-iron tank for further treatment, as described later under the head of copper refining. The gold that remains after decantation is washed and dried in centrifugal machine No. 2, melted with low-grade bullion and cast into anodes, in which form it reënters the process and is retreated

FIG. 4. CENTRIFUGAL MACHINES IN WASH ROOM AT SAN FRANCISCO MINT

COPPER REFINING

This process is used at the San Francisco mint to work up the copper occurring as base metal in the bullion, and to recover the copper used to precipitate the silver from the various wash waters. It is similar to the commercial process of copper refining; but it is of special interest here, because the metals of the platinum group, taken into solution in the previous operations, have now accumulated in sufficient quantities to be recovered. Fig. 3 shows the tree of the process.

The wash waters and spent electrolyte from all parts of the refinery, from which the gold and silver have been recovered, are sent to the scrap-iron tank, and there deposit their copper, lead and any precious metals, including those of the platinum group that have escaped from the previous operations. The sludge of cement copper from this tank is washed and drained in wooden tubs with filter bottoms, whence it is transferred to other filter tubs and allowed to air dry, and then is melted down and cast into anodes for refining.

The copper anodes contain lead derived from the silver bullion, metals of the platinum group derived from the gold bullion, and small amounts of gold and silver. They are 5x14 in. by 3/8 in. thick, and are immersed 13 in. in the electrolyte.

The cathodes are started on sheets of lead 3.75x15 in., and when both sides have been coated with a copper deposit of sufficient strength, the copper is stripped off the lead and returned to the cells. This does away with the repeated melting and rolling of sheet-copper cathodes, similar to those of the precious metals used in the gold and silver processes. The cathodes are immersed 11 in. in the electrolyte and receive deposits on both sides. When completed, these cathodes are washed free of the electrolyte, dried and added to melts of coin metal, without previous melting into bars.

The cells are lead-lined wooden boxes, 3x1.5x1.5 ft. deep. Each cell contains 23 anodes and 34 cathodes, hanging in alternate rows, 2 in. apart from center to center.

The electrolyte is copper sulphate and contains 3 per cent. of copper as sulphate, and from 3 to 4 per cent. of free sulphuric acid. The cells are placed in a series of steps, so that the electrolyte flows through them by gravity. A steam ejector lifts the electrolyte from the sump at the lower end and returns it to the head tank, from which it again flows through the cells.

The current used is direct and has a density of 10 amp. per square foot of cathode surface, and a potential of 3.6 volts, which is equal to 0.6 volt per cell. The gold, silver and metals of the platinum group are insoluble in the sulphate electrolyte, and drop to the bottom of the cells as slimes when the anodes are dissolved. These slimes are collected, washed with dilute sulphuric acid, dried and melted into bars. These bars are stored until sufficient have accumulated, when they are treated for the separation of the various precious metals, especially those of the platinum group, that they contain.

Diamond cutting was for many years an exclusive appanage of the Low Countries, where even today one finds no less than 9000 jewel workers in the single city of Amsterdam (*Echo des Mines*), but the industry has also spread into Germany, Switzerland, France and into North America. It was introduced into Switzerland by a man named Michaud, about 1735. In France there are now employed in cutting precious stones about 2000 workers, distributed between Nantua, Gex, and Saint-Claude.

Determination of Meridian

By D. J. Browne*

This method permits Polaris observations to be taken at any hour of the night, and offers an easy graphic method of computing the results.

*Mining engineer, Rossland, B. C.

The mine surveyor, in the course of his work, is often called upon to determine meridian, especially when surveying at remote places out of convenient reach of established survey lines. In such a case, unless he is prepared with the data necessary for one of the solar methods—and these need an accurate knowledge of the time and current tables of solar declination, both of which may be difficult to obtain at short notice—the remaining methods at his disposal are limited to two or three, all based on stellar observations. The best known of these are: (1) Method of equal altitudes, and (2) Observation of Polaris, or another star, at elongation. Both methods are satisfactory, and their accuracy is limited only by the care taken and fineness of instrument employed; but either may entail the disagreeable necessity of an all-night session, with the risk of failure, should a cloud intervene at a crucial moment.

This risk is obviated by the following method, in which the position of the pole is determined by two or more observations on Polaris (in northern latitudes). These may be taken at irregular intervals, at the will of the surveyor; a useful feature, if, owing to clouds, the star cannot always be seen. The only data needed are the polar distance of Polaris, and the approximate latitude of the observer. Between latitudes 25 and 50 deg., knowledge of the latitude to the nearest quarter degree is sufficiently accurate for this purpose.

The polar distance of a star is its angular distance, on the celestial sphere, from the pole. The polar distance of Polaris on Jan. 1, 1911, was 1 deg. 10.1 min., and it is lessening by about 19 sec. each year.

Method of Observation

The field operations are as follows: Set up the transit over a hub of a permanent kind in a spot sheltered from the wind, and with an unobstructed view of the northern heavens. Then, with the horizontal vernier clamped at zero, backsight to another station 100 ft. or more away, the position of which should be precisely indicated by an illuminated plumbline centered over it. Set the lower clamp, reverse the telescope and sight Polaris, following the star with both vertical and horizontal tangent screws until it is at the intersection of the cross-wires, so that both altitude and azimuth can be read. Note the time and read both circles. Then, after an interval of one hour or more, make a second observation.

Theoretically, all the data necessary for determining the position of the pole have now been obtained, but in practice it is desirable to make at least two more observations, as a check against errors of manipulation and to eliminate partly any faulty adjustments of the instrument. With the latter object in view, make the first pair of backsights with the telescope direct, and the last pair with it reversed. The main source of error, to be corrected by this means, lies in the horizontal axis of the instrument, particularly in high latitudes where there is a great difference in elevation between backsight and foresight, owing to the greater altitude of the pole.

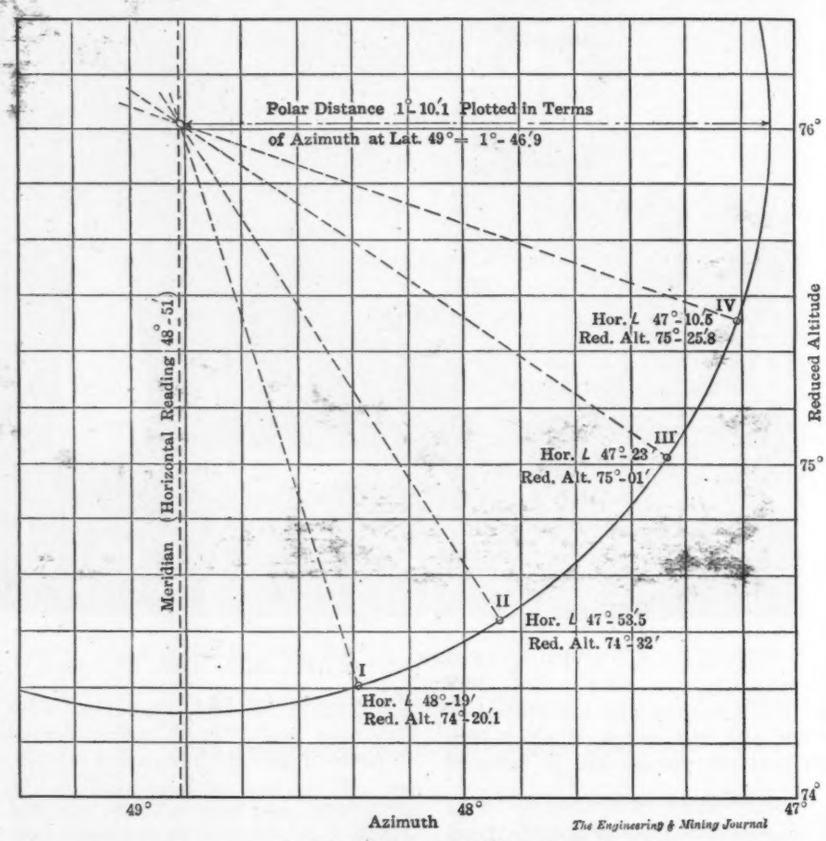
The object has been to find the position, relative to the survey line, of the circular path in which Polaris appears to move round the pole, and this has been done by fixing two or more points in it. The radius of this circle is the polar distance of the star, and as this distance is an angular one, the problem of finding the center belongs to spherical trigonometry. Polaris, however, is so close to the pole, and consequently involves so small a portion of spherical surface in its apparent orbit, that the methods of plane geometry may be used without introducing appreciable error. The task of reducing the observations, therefore, becomes the simple one of finding the center of a circle, given two points in its circumference, and its radius.

Graphic Solution

This may be easily and quickly done graphically, especially if squared paper be used, by plotting the horizontal components of the points on the circle as abscissas, and the vertical components as ordinates, first reducing the radius, or polar distance of the star at elongation, to terms of azimuth. In explanation of this, it should be pointed out that polar distance is measured in a plane either containing, or parallel to, the earth's axis; and that in consequence, it is not the same angle as the azimuth of the star at elongation, except at the equator. The relation for any latitude is:

Sine azimuth = sine polar distance ÷ cosine latitude.

Hence it follows that the azimuth of a star at elongation is variable with the



Determining the Meridian

latitude, and increases as the observer goes north, until a latitude equal to the complement of the polar distance is reached when it would be N. 90 deg. E., or N. 90 deg. W., according as the star is in eastern or western elongation.

Now, a little consideration will show that the horizontal and vertical readings of the transit, if plotted to the same scale, will indicate the apparent path of Polaris, not as a circle, but as an ellipse. This is because the abscissas represent azimuths and not horizontal components, or projections of polar distance, while the ordinates, or altitudes, are true vertical components of polar distance. Therefore, in order to restore the circular form to the orbit, the altitudes must be plotted to a scale greater than that of the azimuths according to the ratio, azimuth at elongation ÷ polar distance. Thus, if a length of 3 in. represents 1 deg. of azimuth, then 1 deg. of altitude should be represented by a length of 3 in. × azimuth ÷ polar distance. When, however, the latter scale is such as to be difficult to adapt to prepared squared paper, plot instead the product, altitude × azimuth at elongation ÷ polar distance (preserving its angular form of degrees and minutes) on the ordinate axis, 1 deg. of this "reduced altitude" being drawn to the same scale as 1 deg. of azimuth. The observations having been plotted in this way, find the center of the circle, or the pole, with dividers or compass set to a radius representing azimuth at elongation.

When working to an error limit of 30 sec., which is all that is usually required of the mine surveyor, it is not necessary to apply the correction for refraction at latitudes higher than 10 deg., as a glance at the following table of mean refractions will show:

TABLE OF MEAN REFRACTIONS

Computed from barometer 30 in., and temperature 50 deg. F.

Altitude	Refraction	Altitude	Refraction
Deg.	Min. Sec.	Deg.	Min. Sec.
10	5 19	20	2 39
11	4 51	25	2 04
12	4 28	30	1 41
13	4 07	35	1 23
14	3 50	40	1 09
15	3 34	45	0 58
16	3 20	50	0 49
17	3 08	60	0 34
18	2 58	70	0 21
19	2 48	80	0 10

As there is little more than 2 deg. difference in altitude between the upper and lower culminations of Polaris, the correction for refraction is, for our purpose, the same for all positions of the star. If, however, the observations have been made with the double object of determining both azimuth and latitude, it is hardly necessary to say that the correction must be applied.

EXAMPLE OF THE PROCESS

The following is a practical example of the method:

Latitude of observer, 49 deg. N.

Date, Jan. 1, 1911.

Polar distance of Polaris, 1 deg. 10.1 minute.

The instrument was a 4-in. mine transit, with full vertical circle, both circles reading to minutes and by estimation to half minutes. Four observations were made, at intervals varying from 1 to 1½ hours, first backsighting to a station situated about 100 ft. to the southwest, inverting the telescope, and turning a left deflection angle to Polaris. The first pair of backsights were taken with the telescope direct and the last pair with it reversed. Then, after calculating azimuth at elongation as follows:

$$Sin.\ azimuth = \frac{sin.\ polar\ distance}{cos.\ latitude.}$$

$$= \frac{sin.\ 1\ deg.\ 10.1\ min.}{cos.\ 49\ deg.} =$$

$$sin.\ 1\ deg.\ 46.9\ min.$$

$$Log.\ sin.\ 1\ deg.\ 10.1\ min. = 8.309410$$

$$Log.\ cos.\ 49\ deg. = 9.816943$$

$$Log.\ sin.\ 1\ deg.\ 46.9\ min. = 8.492467$$

the vertical reading at each observation was reduced to the form necessary for plotting, as shown below:

REDUCED FIELD NOTES

Observation No.	Time	Horizontal Angle	Observed Altitude	Reduced Altitude (Altitude × azim. at elong.) / polar dist.
		Deg. Min.	Deg. Min.	Deg. Min.
1	7:10 p.m.	48 19	48 44½	74 20.1
2	8:10 p.m.	47 53½	48 52½	74 32
3	9:40 p.m.	47 23	49 11½	75 01
4	10:40 p.m.	47 10½	49 28	75 25.8

The third and fifth columns were plotted on squared paper as abscissas and ordinates, respectively, with the result seen in the accompanying diagram, the scale being 1 in. to 20 min. Then, with compass set to a radius representing 1 deg. 46.9 min., the position of the pole was found by the intersection of arcs drawn with centers at each plotted point in turn. Its azimuth reading was angle, left 48 deg. 51 min.; hence the bearing of the survey line from back station to instrument was N. 48 deg. 51 min. East.

Iridium has advanced rapidly in price, having risen from $33 per oz. in 1909 to $65 per ounce.

Preparing Pure Titanium

M. A. Hunter and E. C. Jones describe, in the *Engineering and Science Series* of the Rensselaer Polytechnic Institute publications, Feb. 1, 1911, their attempts to prepare pure titanium. The reduction of sodium titanifluoride by potassium yielded material containing up to 73.2 per cent. of titanium. With potassium and barium titanifluoride a still poorer product resulted. The reduction of titanium dioxide by carbon yielded a material containing in no case less than 4.6 per cent. of carbon. It is doubtful whether metallic titanium can be thus prepared; Nilson and Petersson (*Zeit. physik. Chem.*, 1887, 1, 25), by reducing tetrachloride of titanium with sodium, produced a material containing about 95 per cent. of titanium. Pure titanium has been obtained by this method, extreme care being taken to exclude air from the apparatus, which consists of a steel bomb with a clamped-down lid. The reaction takes place almost instantaneously on heating the bomb to dull redness. The product is partially melted by the heat of the reaction. Analysis of the product by two methods gave, respectively, 99.9 and 100.2 per cent. of titanium, while no trace of sodium or iron could be found. In appearance the metal resembles polished steel. It is hard and brittle when cold, but at a red heat it can be easily forged. The melting point of the pure metal was found to be between 1800 and 1850 deg. C., its specific gravity 4.50, and its specific heat 0.1462 at ordinary temperature.

Rhodesian Chromium Ore

An important deposit of chromite occurs at Selukwe and is being actively worked. The output has increased greatly within late years. During 1910, shipments amounting to 44,002 tons, valued at £98,132, were made. The total production to date is 94,044 tons, valued at £226,420. The output is rapidly increasing this present year, and in the month of April alone, the value of the output was £17,625. The deposit at Selukwe is a huge segregated mass associated with serpentine, and being easily quarried, and in close proximity to the railroad, the cost of mining is low, and the supply is exceedingly large.

Chromite is known in many other parts of southern Rhodesia, for example, at Victoria, Makwiro, Lomagundi, etc., and it is not unlikely that large bodies exist there. The chromic-oxide content of these ores varies, and is sometimes low, as, for example, at Makwiro. The deposits appear to be connected with the great intrusion of picrite which runs north and south through southern Rhodesia from the Zambesi river almost to the Limpopo, and is marginally altered to serpentine in several places.

The Mineral Region of Collahuasi

By Manuel C. Gonzales *

The mines of the Collahuasi region in Chile produce high-grade copper ore containing gold and silver. The veins are filled fissures in the upper parts of which copper sulphate and silicate minerals are found.

The mineral region of Collahuasi is on the western slope of the Andes, at an elevation of 4805 m. above sea level, in the jurisdiction of Tarapaca, Chile. The latitude, 21 deg. south, and great altitude account for the cold, but dry and healthy climate.

The region is accessible from Iquique by the La Granja branch of a railroad, from a station on which a cart road leads to the mines; from Antofagasta a railroad is crossed at Oyagüe by a road leading to the mines.

Compania Minera de Collahuasi, La Grande

The ore deposits worked by the Collahuasi Mining Company are typical of the mineral occurrences in the district. The company owns 251 claims of a total area of 1211 hectares, the greater number on Collahuasi hill; the others on nearby hills. The mines have been developed to a maximum depth of 500 ft. The oxidized zone extends to a depth of about 100 m., in which are argentiferous copper ores containing about 20 per cent. copper. Below this level the ore is chalcopyrite.

*Mining engineer, Casilla 326, Iquique, Chile.

A Typical View in the Collahuasi District, Chile

Geological Features

The major axis of Collahuasi hill trends northeast. The hill is made up of rhyolites, andesites and dacites crossed by dikes of quartz porphyry, diabase and melaphyre striking N 30 deg. W. The veins, of epigenetic origin, are true fissures, filled with the minerals brochantite $CuSo_4$. $3Cu(OH)_2$ and its variations, langite $CuSO_4$. $3Cu(OH)_2 + H_2O$, arnite $2(Cu\,O\,H)_2\ SO_4$. $Cu(O\,H)_2 + 3\ H_2O$ and herrengrundite $2(Cu\ OH)_2\ SO_4$. $Cu(O\,H)_2 + 3\ H_2O$ and with the silicates of copper and iron, and *bronces plateados*, or mixtures of copper and iron sulphides. Where two or more veins unite the width is from two to eight meters.

The Principal Veins

The gangue is quartz and decomposed eruptive rock. The veins strike and dip at various angles; so far no changes of dip and strike have been found to be accompanied by variations in the mineralization. The principal veins and their strikes are: Anita, N 15 deg. E; Delirio, N 10 deg. E; Don Eduardo, N 25 deg. W; Pergolesi, N 30 deg. W; Jilguero, N 30 deg. W; Tiuque, N 40 deg. W; Hortensia, N 77 deg. W; and San Nicolas, N 80 deg. W. No veins striking more to the east than N 15 deg. E are known.

The fissures were formed by contraction of the rock when cooling, by vertical and horizontal dislocation and by the intrusion of the dikes. The last are the most common, and their mode of formation satisfactorily accounts for the many changes in dip of the veins formed by the filling of such fissures. Mechanical disturbances, such as sinking of the hanging upon the foot wall, are rarely noted, but faults produced by forces acting laterally are frequently found in the Anita and Hortensia mines, in the southern part of the district. When faults are encountered the broken-off portion of the vein is sought for by drifting in the direction indicated by the appearance of the undisturbed part. A few outcrops have been discovered. Some veins do not outcrop, while the existence of others is indicated at the surface by slight depressions in which the apices are hidden beneath a cover of detritus.

Methods of Mining

All the mines actually being worked are entered through vertical shafts equipped with steam hoists. Levels are usually 22 m. apart. They are laid with tracks for the cars used to tram the ore, sent down to the chutes in the levels through raises, to the shaft. Mining is not done according to any fixed system, but is governed according to the form and situation of the ore and according to the skill of the miner.

Pillars are left where necessary to support the walls, preferably where the ore is low grade. The walls are also supported by waste filling, long stulls, or small cribs of timber filled with waste.

It is the custom to raise nothing but ore to the surface.

The monthly production of the mines amounts to 1500 to 2000 metric tons containing 15 to 30 per cent. copper and appreciable quantities of gold and silver. The mines have been worked for 10 years with results most satisfactory to the owners. The development work so far done has shown a network of veins; there is yet much virgin ground where no work has been done. Some blocks of ore have been mined but little and only to moderate depths. There is much to be expected from further development, especially in the deeper portions of the veins. The richest masses of ore have been found where two veins come together at an acute angle; at such places the copper content is high.

Origin of the Ore

The typical veins of the region are those known as the Delirio, Don Eduardo and Pergolesi. To a depth of 110 m. in the Don Eduardo shaft and almost 200 m. in the Pergolesi shaft the ore contains subsulphate of copper and silicates of iron and copper. Below these levels the ore is white, compact quartz.

The minerals of the veins were formed from ferrous and ferric sulphates, copper sulphate, silicic acid and diverse silicates. These were held in solution in the mineralizing waters that accumulated in the fissures where reactions took place resulting in the precipitation of the silicic acid as the quartz found in the deeper parts of the veins. The silicates and sulphates of copper and iron were deposited above the quartz zone where, during a second period of chemical evolution, they were acted upon by descending alkaline waters which caused the formation of the subsulphate salts, such as brochantite. These minerals are now found from the quartz zone, at a depth of 100 to 200 m., to the surface.

Some of these later mineral-bearing solutions passed through channels to collect in the Huiquintipa hollow where the subsulphates of copper and silicates of copper and iron accumulated and, becoming mixed with detrital material, are now found in the form of a bedded deposit. In the Copaquire basin some of these solutions were concentrated by natural evaporation, forming a bed of crystalline copper sulphate. The sides of the hills about Huatacondo are covered with iron and copper-stained rocks which have the appearance of having been metamorphosed.

Occurrence of Gold and Silver

The Collahuasi ores contain gold and silver associated with the copper minerals. The gold occurs in the brochantite and copper-iron silicate minerals in the native state but is not visible. Gold is also found in visible grains and plates in the copper-iron sulphide minerals always associated with dark yellow quartz. In the Chicla ravine, 5 km. southwest of Collahuasi small auriferous deposits are worked by washing.

San Luis Potosi Salt Industry

A most interesting natural feature of the state of San Luis Potosi is the salt springs at Salinas, a station on the Mexican Central railroad, about 55 miles northwest of the capital. In the rock formations of the vicinity there is no indication of salt deposits and there is no evidence of the local origin of the saline waters. The springs are at an elevation of about 7600 ft. above sea level in a small basin of sand and calcareous matter. The surrounding hills are of cretaceous limestone and the basin is evidently an old lake bottom. All subsurface water for many miles around is slightly salty. It is thought that the stream comes from the north, possibly as far as Chihuahua, under pressure. The springs discharge from a depth not exceeding 20 ft. into a shallow lagoon, the spring region comprising about 600 acres. The lagoon is never more than 10 in. deep and at times entirely dry with a surface crust of saline matter.

Method of Manufacture

The water is pumped into tanks and naturally contains 4 to 7 per cent. of salt; it is then evaporated and begins to crystallize at 18 per cent. The mother liquor is finally drained off and the salt swept out. Below a depth of 20 ft. the salt content of the water diminishes and entirely disappears at 100 ft. Fresh water is found in the locality at a depth of about 600 feet.

The records of the salt works at Salinas date back to 1792, when the Spanish government first took the springs as a source of revenue, but it is known that the Indians used the saline top soil long before that year. In 1862 the Mexican government began leasing the salt works, in triennial periods, which continued up to 1842, when they were sold outright. British capitalists bought these with other Mexican salt springs in 1906. This English company is now the largest salt producer in Mexico and Salinas is its largest source of supply. The Salinas springs at present yield from 15,000 to 18,000 tons of salt per annum, nearly one-third of the output of the whole republic. However, these springs are not operating to full capacity, as they are capable of furnishing more than 100,000 tons annually. The company employs about 350 men at Salinas. The production was formerly much larger, running as high as 45,000 tons per annum when salt was used in the treatment of silver ores, a method latterly displaced by the cyanide process. The market for salt is entirely domestic. Much of the product is shipped to Mexico City, at a freight rate of $5.93 per metric ton.

[1]*Daily Consular and Trade Reports*, Aug. 16, 1911.

Some Crystallization Oddities

An analysis of the product of the Salinas springs is as follows: Sodium chloride, 98 per cent.; sodium sulphate, 0.5 per cent.; organic matter, 1 per cent.; lime, 0.5 per cent. The first-class salt is sold for domestic use, second-class to slaughter houses, and third-class to cattle raisers. In 1873 the evaporation process was installed and is still in use. The effect of the weather upon crystallization is curious. When it is dry the crystals are large and well defined; when it rains or there is a damp wind the salt crystallizes in fine grains; or again, rain will stop the crystallization entirely or retard it for many days. Even after crystallization has taken place in lumps as large as hazelnuts, a damp wind or a rain will reduce the whole mass to a fine granular state.

Cyanide Mills in Chihuahua

Chihuahua Correspondence

The following is a list of cyanide mills in the state of Chihuahua, Mexico:

Dolores Mines Company, W. H. Paul, manager, Madero; capacity, 150 tons.

Republica Mining Company, J. Gordon Hardy, manager, Sauz, via Ocampo; capacity, 75 tons.

Rio Plata Mining Company, D. W. Shanks, manager, Guazapares; capacity, 75 tons.

Sierra Mining Company, Robert Linton, manager, Ocampo; capacity, 25 tons.

Concheño Mining Company, R. B. Hutchinson, manager, Concheño; capacity, 50 tons.

Yoquivo Development Company, Charles Qualey, manager, Cuesta Prieta; capacity, 100 tons.

Batopilas Mining Company, W. M. Brodie, superintendent, Batopilas; capacity, 75 tons.

Santo Domingo Mining Company, Batopilas; capacity, 25 tons.

Palmarejo & Mexican Goldfields, Ltd., George E. Stephenson, manager, Chinipas; capacity, 100 tons; 300-ton mill under construction.

Palmilla Milling and Mining Company, James I. Long, manager, Parral; capacity, 300 tons.

Veta Colorado Mining and Smelting Company, C. F. Spaulding, manager, Parral; capacity, 200 tons.

El Rayo Mines Company, James Colbath, manager; capacity, 100 tons.

Cherokee Goldfields, Ltd., Harold Higgins, manager, San Julian, via Parral; capacity, 75 tons.

Watterson Gold Company, Ltd., Ocampo; capacity, 100 tons.

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

W. R. Ingalls has returned to New York.

F. Augustus Heinze visited the Porcupine gold camp in Ontario recently.

E. A. Ritter, of Colorado Springs, Colo., is in Utah investigating the carnotite deposits.

A. C. Perkins has been examining dredging ground in the Perm district in Russia.

R. E. Smith, of California, has been prospecting in the Nertchinsk district, in Siberia.

S. H. Ball has returned to New York from geological work in Sonora and Chihuahua.

H. W. Turner is making a geological study of the Ufalei Estate, near Ekaterinburg, Russia.

T. H. France, of New York, has been in the Porcupine district, Ontario, making examinations.

J. P. Hutchins, of New York, is at present making his headquarters at St. Petersburg, Russia.

E. D. McDermott has resigned his position at the Kyshtim mines in Russia and has returned to London.

Arthur Howe Carpenter has returned to Denver, Colo., from professional work in Wyoming and Nevada.

C. W. Purington, who has been testing alluvial deposits in the eastern part of Siberia, has gone to London.

Edward R. Zalinski, of Salt Lake City, Utah, has been examining the Golden Prince mine at Pioche, Nevada.

D'Arcy Weatherbee, Norman C. Stiner and William Knox are drilling placer ground near Nikolaievsk, Siberia.

F. Hille, of Port Arthur, Ont., is making an examination of the Big Master mine, Manitou Lake district, Ontario.

A. J. Hoskin, of Denver, Colo., is now engineer for the Moore Mining Company, operating near Alma, Colorado.

Bert Poirier, recently in charge of the Vipond mine, has been appointed consulting engineer of the Rea mine at Porcupine, Ontario.

T. R. Laurendeau has purchased the interests of J. W. Blanchet in the Hughes Porcupine gold mines and becomes manager of the company.

James W. Goudie, of Ironwood, Mich., will be in the Porcupine district in Ontario during the winter, and will examine and report on mining properties.

J. Campbell Besley has moved his headquarters from Hermosillo, Sonora, to Magdalena, where he is developing gold mines in the Tucabe district.

Todd C. Wordworth and W. R. Layne have returned East from the Muchacho Grande property near Alamos, Sonora, Mexico, which they are developing.

C. W. Carpenter, of New York, secretary of the Colorado Vanadium Company, has been at the company's properties in San Miguel county, Colorado.

E. P. Merrill, formerly at Pachuca, Mexico, is now in charge of the Western business of the Island Creek Coal Company, with headquarters at Minneapolis.

L. Maurice Cockerell has recently returned to his headquarters at Chihuahua, Mexico, after an extended trip to California and Alaska on mine-examination work.

Prevost Hubbard, of Washington, consulting chemist, has been appointed chief of the Division of Roads and Pavements recently organized by the Institute of Industrial Research.

Rollins S. Foster and David H. Hoffman, of Butte, Mont., sailed from New York, Nov. 11, on their way to join an expedition organized to develop mines in the Congo Free State.

A. C. Dart has resigned his position as general manager of the Rambler Copper and Platinum Company at Holmes, Wyo., and is now connected with the United States Zinc Products Company at Cañon City, Colorado.

Horace G. Young, for the past 16 months manager of the Temiskaming & Hudson Bay mine, Cobalt, Ont., has resigned. A. H. Brown, at present operating the Pike Lake property near Swastika, has been appointed as his successor.

Dr. Horace V. Winchell represented the American Institute of Mining Engineers at the inauguration of George E. Vincent as president of the University of Minnesota. Prof. A. N. Winchell was the delegate appointed to represent the Geological Society of America. Professor Winchell is now conducting an examination of the Idaho-Maryland mines at Grass Valley, Cal., after which he will go to Idaho and Montana.

OBITUARY

Frederick P. Addicks died in New York, Nov. 2, aged 61 years. He was born and educated in Philadelphia, and after some early business training he became interested in gas and went to Chicago as secretary and treasurer of the Consumers' Gas Company of that city. In 1887 he went to Boston, where he became treasurer and general manager of the Boston Gas Light Company, and was interested in other lighting corporations of nearby towns. He moved to New York in 1889 and became connected with the Amalgamated Copper Company. For some years past he had been vice-president of that company and treasurer of the Anaconda Copper Company.

SOCIETIES and TECHNICAL SCHOOLS

Colorado School of Mines—George W. Schneider, professor of mining, delivered an address before the mining men of Leadville, Colo., Oct. 26, on "Business Methods of Mining." This was one of a series of lectures to be given by various speakers in the several mining camps of the State, under the auspices of the Colorado School of Mines and the Colorado Scientific Society.

American Institute of Mining Engineers—A meeting of the New York Section was held Nov. 3, at which Dr. F. L. Hoffman, statistician of the Prudential Insurance Company, delivered an illustrated address on "Safety Devices and Appliances in Mines and Metallurgical Works." An address on the same topic was also made by Dr. William H. Tolman, director of the American Museum of Safety.

American Society of Mechanical Engineers—At the monthly meeting in New York, Nov. 14, the topic for discussion will be "Autogenous and Electric Welding." Three papers will be presented: one dealing with the general aspects of the subject, the origin and principles of each process and the apparatus used in each, by H. R. Cobleigh, International Steam Pump Company; and two on special phases, "Thermit Welding," by G. E. Pelissier, superintendent Goldschmidt Thermit Company, and "Electric Welding," by C. B. Auel, assistant manager of works, Westinghouse Electric and Manufacturing Company.

American Institute of Chemical Engineers—The fourth annual meeting will be held at Washington, Dec. 20 to Dec. 22, and will be largely devoted to the question of patents. At the Chicago meeting a committee was appointed to prepare an expression of views in regard to the recognized evils of the present patent practice, communicate this action to other societies and also to President Taft. It has been pointed out that other societies are passing resolutions on this question, and that if the resolutions filed with the President by the end of December are numerous enough, be may be induced to mention patent law reforms in his first message to Congress and we may have some hope of early action. President Taft is a judge who has had experience in patent cases and can appreciate better than others might the necessity for these reforms. On the other hand it is pointed out that, if the matter is allowed to drag, no action may be taken until the need arises for another message to congress, probably in March or April, when Congress will have campaign policies so much at heart that non-political subjects will be ignored. Papers on other important subjects will be presented, and there will be visits to chemical plants in Baltimore and vicinity.

Editorial Correspondence

Reports from our own Representatives on Important Events from Many Important Mining Centers of the World

San Francisco

Nov. 1—Mining activity in that portion of northern California embracing the counties of Shasta, Trinity and Siskiyou is marked by three distinctive features: The exploration and development of new ground; the installation and operation of gold dredges; the advanced development of old hydraulic mines. In Shasta county the exploration of the copper region adjoining and connecting the established mines is proceeding with reported favorable results, and in gold-bearing quartz districts there is evidence of advancement, while the interest in dredging lands is perhaps greater than at any other recent period. The operations are proving the worth of the lands lying south of Redding, on Clear creek, and the live channel of Sacramento river to the north. Little publicity is gained by this work, yet the fact stands out plainly that these operations are evidently profitable, and that there are large areas prospected but undeveloped.

Trinity county mining fields are commercially tributary to Redding, and though the county contains neither a mile of railroad nor a flour mill, it is, in the present season, one of the most vigorous and proportionally prosperous districts in the northern part of the State. The recent acquisition of old hydraulic mines and claims by large capital has drawn attention to the extensive general resources that will, in the future, be exploited and developed by new and advanced methods. Weaverville is by this activity, coming into particular notice. Along Trinity river, from Lewiston north and including Minersville and Trinity Center, there are gold dredges under construction, the installation of which in the early season of 1912, should prove the possibilities of the river lands, under the application of the different types of dredges. These lands have been fairly prospected, and the fact that capital will risk long and expensive wagon haul of machinery from Redding and other points on the Southern Pacific in Shasta county, is good proof of the faith of investors.

The western half of Siskiyou county is attracting capital from Seattle, as well as from San Francisco and other financial and commercial centers. There are, along the downward flow of Klamath river, some clam-shell, orange-peel and suction types of dredges. Little is known of either the success or operation of these boats, even within the county, for Siskiyou is a region of long distances and large mountains. On the bars of Scott river improvements are being made for the winter run of the hydraulic and quartz mines, and on McAdams creek bucket dredging is active and prosperous. There is especial activity in the Humbug Mountain district, in the practical development of new mines on quartz claims that have heretofore been worked chiefly with the prospector's pick and shovel, and also in the renewal of active work in the established quartz mines. Western Siskiyou has only a short trackage of railroad, connecting Yreka with Montague on the Southern Pacific main line, that divides the gold-bearing portion of the county from the east side. But, as in Trinity, there is no sign of any lack of hopefulness or energy on the part of either the quartz or the gravel miners.

Denver

Oct. 31—The Cripple Creek district continues to increase its activity and production. The deep-drainage tunnel having started again has given an impetus to new work and the general revival has given courage to new and old operators. The output for October is given at 77,728 tons of gold ore of a bullion value of $1,318,199, this being 1000 tons in excess of the September output. The dividends paid in the last month were as follows: Golden Cycle, $1,500,000, special; Golden Cycle, $30,000, regular; Portland, $60,000; Vindicator, $45,000; Elkton, $37,000; Close Corporations, $100,000; total, $1,322,500. These do not, of course, include the profits made by leasers. The drainage-tunnel main heading has been driven east 100 ft., and the flow of water has increased 1000 gal. per min. At this rate of recession the deep levels of all the big mines will be unwatered in five or six months, resulting in larger forces of men being employed and a still further increase in production.

The news of the week in all the principal mining camps, though devoid of startling discoveries, is full of the reopening of mines long idle, of the installation of improved machinery in working mines, sinking shafts deeper, driving long development tunnels and other indications of the flow of capital into the mining channels of the State. Leadville is particularly active in this respect, but all the camps seem suddenly in a hurry to prepare for a heavy winter's work, and for the good times which the miners believe are coming for this industry.

Salt Lake City

Nov. 2—The equipping of the concentrating plant of the Ohio Copper Company with Wall rolls is yielding the company better results. A total of 20 rolls will be installed and of this number eight are in place. Of these, seven sets are for coarse and one set for fine crushing. The amount of ore sent through the mill on Oct. 23 was 2350 tons in 24 hours. During the last week in October the daily output approached 2000 tons as compared to a former average of 1300 tons. The rolls are being made by the Salt Lake Engineering Works and are being gradually put into place, so as not to interfere with the treatment of the regular tonnage. The remaining rolls should be installed within 90 days, when the capacity of the mill will be still further increased to about 3000 tons per day. During October the grade of the ore improved somewhat, averaging about 1.3 per cent. copper. The extraction was reported good, though no figures have been made public. Concentrates carrying from 25 to 32 per cent. copper in some cases, have been obtained. A compressor with a capacity of 2000 cu.ft. of free air per min. is being installed at the mouth of the Mascotte tunnel at Lark, in order to facilitate the increased production which will be possible with the new machinery.

The local U. S. Assay Office, during October, handled 4319 oz. of gold amounting to $80,359 and 1053 oz. of silver worth $560. This makes a total of $80,919, which is somewhat less than the general monthly average of from $130,000 to $150,000. The decrease is due to lessened shipments from Nevada, notably from the camp at National, where one of the mills is being overhauled. Since the establishment of the office, there has been a steady increase in the amount of bullion handled. In 1908, $900,000 worth of gold and silver passed through the office; in 1909 the amount was $1,025,000; in 1910 the largest business was done, amounting to $1,375,000. It is estimated that the amount of bullion handled in 1911 will be more than double that for 1908, or approximately $2,000,000.

The recent annual report of the Consolidated Mercur Gold Mining Company was not an optimistic one and in view of this it is interesting to note that operations for September show a profit. The gross output for this month was approximately $48,000, while operating ex-

penses were slightly over $46,000. This surplus is not large, though it is good compared with the monthly profits for 1910. The output for October promises to equal that for September.

Placerville, Colo.

Nov. 1—The vanadium and uranium areas of this section are apparently attracting renewed attention from outside interests. During the last month examinations have been made in the district by several engineers including H. A. Prosser, Kirby Thomas, and E. A. Ritter, the first two representing eastern interests and the latter a French company. J. J. Flannery, president of the American Vanadium Company, has been here inspecting extensive holdings in the Paradox district controlled by him and Angus Cameron. A member of the W. H. Lorimer Sons Company syndicate, of Philadelphia, which also has large interests in the Newmire vanadium district and in the Colorado-Utah carnotite deposits, has been here several weeks. Some of the steel companies of the East have representatives here permanently now, and numerous agents of the ore-buying companies have visited the district recently. The shipments at present are mostly confined to the carnotite ores which run about 4 per cent. U_3O_8 and 3 per cent. U_2O_5. The chief sources of these is in the Paradox valley in western Colorado and the ore is brought to Placerville, 90 miles, by wagon at a cost of about $22 per ton for hauling. It is currently believed that these ores are used for making radium salts because of their radioactive properties. The shipments go to Europe and to Pittsburg. The freight east from here is about $11 to Pittsburg and $13.50 to Europe. The Newmire mill of the Primos company, treating vanadiferous sandstone from the Bear creek deposits, is treating about 27 tons per day and it will run all winter according to announcement. This company is now offering ferro-vanadium for $3.50 per lb. for the metallic vanadium content; the quoted price heretofore has been $5 per pound.

Butte

Nov. 1—The recent destruction of the concentrator of the Butte Reduction Works by fire, necessitating the closing of the works and reducing of the force employed at the Elm Orlu mine from 180 men to 30 men, means a loss of $30,000 per month in the payrolls. The 30 men still being employed at the mine can only be used to advantage for about 10 days, in retimbering and repairing, after which the mine must be closed, as the orebins are full and no more ore can be mined until other arrangements for the disposal of the ore are made. Until the expected arrival in Butte of W. A. Clark, owner of the Elm Orlu mine, nothing can be ascertained as to plans for future disposal of the ore, and as John Gillie, general superintendent of the Anaconda company, is in the East, no word has been given out concerning the rebuilding of the ruined plant, which, even if begun at once, would require until next summer to complete.

Butte Coalition may be cited as an example evidencing the sluggish condition of the present copper market, for at $17 per share, which is a little above the present market price, it is selling for about $5 per share less than the value of its treasury assets; the company is now only a securities-holding company with its mining property transferred to the Anaconda company. In its treasury are $3,850,000 in cash, 517,566 shares of Anaconda stock worth $17,856,027 with the stock at $34.50, and 3000 shares of International Smelting stock worth $360,000 with the stock at $120, bringing the total assets up to $22,066,027, or $22.06 per share on the 1,000,000 shares of stock outstanding.

Negaunee, Mich.

Nov. 2—The dividend of the Cleveland-Cliffs Iron Company, authorized at the October meeting, will be but half the dividend that has been paid in recent years. This action of the directors is based on two reasons: The unsettled condition of the iron market and general industrial affairs, with small prospect of improvement in the presidential election year of 1912; and the large expenditures which the company has undertaken recently in the development and improvement of its mines and furnaces. The company has spent a great deal of money in the last few years; for instance, its water-power plant now under construction on the Carp river, near Marquette, which will furnish power for operating the Cleveland-Cliff mines on the Marquette and Swanzy ranges, is estimated will cost $1,000,000. In addition there have been large expenditures in diamond drilling in the Iron River district; the North Lake properties, west of Ishpeming, and the Swanzy range properties around Gwinn, have taken large sums for development and building of townsites. It is reported that the earnings of the company were sufficient to pay the usual dividend but that it was thought best to be conservative and to reserve a portion for a surplus.

Regarding the sentiment in the iron-ore districts toward the Steel Corporation, there is a strong feeling favorable to the organization, due to its excellent treatment of employees. Good wages have always been disbursed about which there was no uncertainty as to the payment; comfortable mine dwellings have been provided; provision has been made for doctor services, for men incapacitated by injuries, and for old-age pensions; also, employees have been given opportunity to purchase stock in the company on payments to be deducted from their wages, of which a large number have taken advantage. In the older mining towns, where the company is operating, many of the employees have but a few years more to work before they will be retired on a pension sufficient to keep them, when taken in conjunction with dividends on their stock holdings.

Wallace, Ida.

Oct. 30—The Washington Water Power Company, which supplies the power for nearly all the large mines in the district, is planning to build a line over Sunset peak. The survey for the new line is now being run. A substation is now being constructed at the Tamarack & Chesapeake mine. The power will be carried 65 miles from the Post Falls plant at 66,000 volts. A feature of the new line will be a 1300-ft. span, which will stretch across a valley. This new line will be a great help to the Sunset Peak district. This part of the Cœur d'Alenes is practically undeveloped. There are, however, several properties which are in the transition stage between prospect and mine, which need some such influence to make them producers.

Toronto

Nov. 4—The operation of the government peat plant at Alfred, near Ottawa, by the Mines Branch will be discontinued, the object of interesting manufacturers in the production of peat fuel having been accomplished. It is announced that J. M. Shuttleworth, of Brantford, Ont., and associates have contracted to take up the work as a business enterprise and will spend $500,000 in trying an improved Anrep peat machine, which will have a capacity of 60 to 80 tons per day, as compared with the 30 tons turned out by the government machine.

At a recent luncheon of the Canadian Club in Ottawa, Chairman J. L. Englehart, of the Temiskaming & Northern Ontario Railway Commission, stated that it is intended in the near future to continue the railroad 100 miles farther north toward Moose Factory from Cochrane, the present terminus. He also stated that the Porcupine branch is paying well and that there is a probability of extension.

Porcupine

Nov. 2—A number of prospectors have been staking in the townships of Teck and Lebel, where the latest gold rush is taking place. Some of the claims have free-gold showings and there are stated to be several promising properties.

The winter appears to have started in earnest in northern Ontario and the lakes and rivers are rapidly freezing up. So far not much snow has fallen, but a little keeps coming every few days, and it will not be long before toboggans can be used in the bush. The cold weather will be welcomed by many of the companies as it will mean a large reduction in the cost of hauling supplies.

The Mining News

Reports of New Enterprises. New Machinery. Installations. Development Work and Property Transfers. The Current History of Mining

Alaska

The custom stamp mill at Valdez is now in operation, and ore is being brought in from many of the surrounding properties. Tons of high-grade ore from the Woods-Olson group, the Valdez Mining Company and the Williams-Gentzler Company have already been landed at the mill.

Glacier Creek—This property which was located by Peter Erickson, of Valdez, has been sold to Cappell, Radclyfee & Co., an English syndicate. The property is near the Bonanza mine.

Alaska Gold Quartz—This company is considering the installation of a 5-stamp mill and other machinery in the early spring. Milo Kelly, Seward, is manager.

Alaska-Treadwell—For the month ended Sept. 30, 38,640 tons of ore were crushed, yielding $90,245 gross and net $41,489. Operating expenses were $40,432; construction, $8324. The ore averaged $2.36 per ton.

Arizona

Gila County

Miami—The company has increased its tonnage to 2000 tons per day. The mine has thus far easily kept the mill supplied with ore. The fifth section of the mill is ready except for the shafting, which has not yet arrived. The mill recovery is about 75 per cent. and the daily production of concentrates amounts to about 100 tons, averaging over 40 per cent. copper, the concentration ratio being 20 into 1. The concentrates are shipped to Cananea. The mill is in charge of F. W. Solomon, formerly superintendent of the Nevada Consolidated mill, at McGill, Nev. The new power-house equipment is arriving and the 1200-kw. generator set is being installed.

Inspiration—A force of mining engineers is at work on plans for mining the orebody and the staff of construction engineers is being organized and assembled. F. J. Brule will have charge of construction. Orders to begin this work are expected soon. The only underground work going on at present is the laying of track on the main tunnel level. This will be one of the main haulage levels and the track is being laid to 36-in. gage. The bed of Pinal creek, near Wheatfields, is being tested for the dam foundations, and a temporary diverting dam is being built. Various preliminary surveys are being made. The site for the new 5000-ton mill has not yet been selected. T. R. Drummond is local manager.

Live Oak—Sinking of shaft No. 2, situated near the western end of the property, has been discontinued at a depth of 928 ft., having passed out of the chalcocite orebody and into the zone of primary sulphides at a depth of 916 ft. This shaft penetrated the ore at a depth of 705 ft., and the thickness of the deposit has thus been proved to be 211 ft. at this point. The average copper content cannot be learned. For the first 100 ft. it was reported to have averaged about 3 per cent., but the grade is known to have decreased with depth, especially near the bottom of the orebody. Four churn drills are working near the western boundary. The crosscut on the fourth level, from No. 1 shaft, has not yet reached the orebody.

Superior & Boston—A crosscut was driven on the 12th level of the McGaw shaft toward the Great Eastern vein for a distance of 35 ft., but has been temporarily discontinued and the cutting of the sump in the shaft has been resumed. When the sump is finished, work will be renewed in the crosscut, which, it is estimated, will have to be driven 165 ft. to reach the vein. The shaft is at present bottomed in hard diabase, which makes sinking slow.

Pinal County

Ray Central—The company is making preparations for the construction of a mill and surface plant. The mill will be of 1500 tons nominal capacity and will be designed by H. Kenyon Burch, who designed the Moctezuma Copper Company's mill at Nacozari, and the Miami Copper Company's mill at Miami. Mr. Burch is now at the mine making preliminary plans. E. Horton Jones, formerly construction engineer for the Ray Consolidated, will hold a similar position with the Ray Central. A new working shaft will be sunk near the east end of the Isabella claim. It will be of four compartments, approximately 7 by 28 ft. over all and 500 ft. deep. Ore will be hoisted in six-ton skips. An adit will be started at the bottom of Copper cañon, opposite the present office building, at an elevation of the present first level, and will be driven to the shaft. This adit will be used for timber and supplies. The shaft will be driven almost entirely by raising, and drifting is in progress on several levels, toward its proposed site. Assessment work on all unpatented claims has been completed, for the current year. F. M. Probert, consulting engineer, is now at the mine.

Ray Consolidated—The company is mining and milling 4000 tons of ore per day with four of the eight units of the mill in operation. The ore is coming from the stopes of No. 1 and from the development of No. 2 mine. The surface plant of No. 2 shaft is practically completed and will soon be ready for operation. Messrs. Jackling, Penrose, Aldrich and McNeill are expected at the mine in a few days.

Santa Cruz County

Anaconda—The shaft is now 300 ft. deep, and crosscutting has opened up a hitherto unknown vein upon which drifting is being done. The main vein will not be reached by the crosscut for some time. There is much water in this shaft.

California

Amador County

South Eureka—The legal geographical situation of this mine has been fixed as in the Sutter Creek school district.

Lincoln—The north drift on the 1200-ft. level is in 100 ft., the face carrying about 3 ft. of quartz. Good development is looked for in the south drift on the main vein. Drifts are being driven north and south on the 800-ft. level.

Butte County

Forbestown Consolidated Gold Mines—The Gold Bank, Golden Queen, Shakespeare and other claims have been merged under this name. The holdings embrace 1000 acres of patented ground. M. J. Cooney, Oroville, is manager.

Aguas Frias Land Company—This is a new close incorporation of 50 persons, capitalized at $100,000, for the purpose of reclaiming lands that have been dredged for gold near Oroville. No stock shares are to be sold publicly. Charles B. Wingate, of Alameda county, and John Houston, of Scotland, are principal owners.

Eldorado County

Taylor—A tube mill for regrinding will be installed, owing to the cemented character of the tailings, which contain considerable sulphurets.

Humboldt County

Horse Mountain Copper—This company has purchased the Tenderfoot group adjoining its property. The wagon road is finished and the new concentrator is expected to be installed soon.

MADERA COUNTY

There is an unusual interest in prospecting for gold and silver, particularly in Kings Creek district. Thirty-four claims were recently recorded as having been located within 10 days.

MODOC COUNTY

Sunset — Important development of sulphides in the north drift is reported at this mine, near Fort Bidwell. Work is progressing also in the west drift.

NEVADA COUNTY

Prudential—Claims for wages and other accounts aggregating $2000 are reported to have been filed and attachments levied. The property has been operated under purchase bond by George A. Aldrich. About 80 tons of ore have been mined and milled.

PLUMAS COUNTY

There is reported to be promise of a revival of drift mining in the vicinity of La Porte, as a result of a discovery of an old river channel in the rear of Gibsonville ridge and because of contemplated development of Moreville ridge.

SIERRA COUNTY

Gray Eagle—The electrical machinery for the new power plant at this mine, at Gold Point, has been delivered at the power site and will be installed at once. G. A. Adams is manager.

Iron Sides—Ore assaying high in gold has just been uncovered on this property while extending the tunnel near the head of Jim Crow cañon. W. I. Redding and others are owners.

Telegraph—In the tunnel on this property, which is being run for gravel, a vein over 3 ft. wide, carrying rich arsenical sulphurets and showing free gold has recently been encountered. J. W. Finney, of Downieville, with Chicago associates, is operating the mine.

SISKIYOU COUNTY

Columbia—The employment of an auto truck for transportation of ore from this mine on Mill creek, to the five-stamp mill has been abandoned. The distance is about three miles over good road, but with heavy grades that are difficult even for wagons and teams. The owners contemplate a wire tram when developments warrant. J. B. Rowley, Scott Bar, is superintendent.

Pilot Knob—This property, near Gottville, is being thoroughly examined and the ore tested, preliminary to installing a 30-ton cyanide plant. H. C. Miller is in charge of the work.

TRINITY COUNTY

Lappin—This mine, at Deadwood, has closed for the winter and will resume early in the spring.

YUBA COUNTY

Marc Anthony Mines Company—This company has been organized recently to operate the Marc Anthony mine, at Smartsville, recently leased and bonded from the heirs of S. O. Gunning. Recent development is reported to have proved satisfactory for continued operation.

Tarr—The mine, at Smartsville, is pushing construction work in preparation for the operation of a dry-land dredge.

Mulberry Wonder—This mining and milling company has been incorporated to develop the Wonder mine, near Rockerby.

Colorado

CLEAR CREEK AND GILPIN COUNTIES

Gem—An important strike is reported in the mine at the level of the Newhouse tunnel and about ¼ mile east of it. It is stated that Von Tilborg & White, owning the lease, have opened an oreshoot 11 ft. in width, with 2 ft. of it carrying $96 gold and 8 oz. silver per ton. Alongside of this are nearly 2 ft. of galena ore assaying 60 per cent. lead. This ore was opened 2000 ft. below the surface and it is said that 100 tons were broken down with a round of 20 holes.

Lamartine—A carload of concentrates, which netted Carlson & Co., lessees, $800, has just been sent out from the above mine.

Argo—Charles Ketterer, manager of this company in the Daily district, reports that he has 3 ft. of ore carrying gold, silver and lead.

Millington—A discovery is reported in this mine on Columbia mountain, of a 2-ft. vein of gold-silver-lead ore.

Paymaster—Lewis Chiari, leasing on this property in the East Argentine district, has shipped 200 tons of ore worth $90 per ton during the last six weeks.

CRIPPLE CREEK DISTRICT

Jerry Johnson—One of the largest finds of ore for some time is reported from this mine on Ironclad hill. Although of low grade, the orebody is 20 ft. in width and with no walls reached. Fifty-four cars were sent to the mill in October by Frank Caley, lessee.

Gold Coin—The water in the lower workings is going down at a rapid rate and the Granite company, owning the above mine, will be enabled to work the ninth and tenth levels on company account. Dan McCarthy is superintendent. This mine is credited with a large production in the earlier days of the camp, but water ultimately forced it to close down.

Joe Dandy—An unconfirmed report states that a 3-ft. vein of ore has been found, in the center of which is a 6-in. streak of sylvanite returning high assays with 2 oz. of gold ore on each side of it.

Muggie—This mine is shipping about a carload per day of high-grade ore. The mine is situated between Raven and Bull hills, and is under lease to Carl Johnson.

Isabella—The Lee shaft of this mine is now 2710 ft. deep and the output is about one carload per day. The output of the Bull hill mine for October was 44 cars of ore of better grade than usual.

Specimen—A recent output of the mine, leased by Johnson & Argall, was five cars of 1-oz. gold ore.

Union Leasing Company—From the Gold Sovereign, a block on the Prince Albert and the Husted shaft of the Gold Dollar, this lessee shipped 58 cars of ore last month, running from $9 to $30 per ton.

Idaho

COEUR D'ALENE DISTRICT

Hercules—A series of tests are to be carried on in the slime department of the new Hercules concentrator. These tests will be run on the vanners and the Franz and Wilfley tables with and without classified feed and with different thicknesses of pulp. The object of the tests will be to determine the efficiency of the plant, and, if possible, to increase that efficiency.

Tuscombia—This company has just received smeltery returns for the first two cars of ore shipped from the mine. Shipping will be continued all winter. The ore is hauled seven miles by team to Bunn station on the Northern Pacific railroad.

Illinois

ZINC-LEAD DISTRICT

Joplin Separator Company—The roasting and magnetic separating works, at Galena, were totally destroyed by fire on Oct. 23. The loss is estimated at $50,000. This plant used the Cleveland magnetic separator to remove the pyrite after roasting. The plant will be rebuilt.

Kansas

Mastin—Ball & Gunning, of Webb City, have purchased this 145-acre tract at Galena for $16,000.

Lane Williams—Four drill holes on this land, 1½ miles south of Lawton, show 26 ft. of rich ore at a depth of 50 feet.

Pittsburg Smeltery—The company has commenced the purchase of zinc ore in this district and is running one block only at the present time.

Michigan

COPPER

Hancock—The mine has discontinued shipments to the Allouez-Centennial stamp mill. The mill run covered a period of several months and although no official statement has been issued regarding the returns, it is generally understood that the Hancock lodes, from which the rock was taken, carry copper in commer-

cial quantities. The main vertical shaft is sinking at the rate of about 75 ft. per month on its way to cut the Pewabic lode, and is down over 3000 feet.

Superior—No. 1 shaft is being equipped with a large hoisting equipment, purchased from the Tamarack company. No. 1 shaft is bottomed at the 17th level and No. 2 at the 13th, where a drift is being extended to connect the two shafts.

Houghton—The shaft is down about 550 ft., and at a depth of 600 ft. the second crosscut will be started to the Superior lode. At the 460-ft. level the first crosscut reached the lode and found it somewhat shattered, but carrying an 18-in. streak of fine ground.

Oneco—Sinking of the shaft continues to open the ground at a depth of 1200 ft., from which point a rich drill core was extracted. The shaft is now about 900 ft. deep. Copper has appeared from time to time, but no attention will be given to lateral openings until the objective point has been reached.

Ojibway—Shipments to the Tamarack mill have been started. About 150 tons per day are now being shipped, but it is likely that this will be increased as soon as convenient, and the rock will be taken from the underground openings and from the stock pile, which has accumulated in the development of the two shafts.

Centennial—No. 2 shaft is handling all the rock that is now being hoisted, No. 1 shaft being used for men and supplies. The drifts from the lower workings toward the Wolverine property are opening a consistent piece of good copper ground.

Lake—This property will in all probability again enter the producing list within a few months. The rock will likely go to the Trimountain mill of the Copper Range Consolidated Company. The new shaft is down below the ninth level and the ground being opened is of good character.

Allouez—Work is reported to have started on the new shaft house and hoisting plant at No. 2 shaft. The hoist and steel framework has been received.

Iron

Heidelbach—These banking interests of New York have commenced the exploration of 360 acres of their land on the eastern end of the Cascade range. The property is well situated, being mainly within the limits of the known ore formation, and is about two miles east of the village of Palmer in S. 26,-T. 47N.,-R. 26 W. The Cascade range has been in the main a producer of low-grade ores and the Moore mine of the Oliver Iron Mining Company, the Richmond mine of the M. A. Hanna Company, and the Star West mine of Corrigan, McKinney & Co., are of that type. However, the Volunteer Ore Company, in which T. F. Cole, C. A. Tomlinson and others, of Duluth, are interested, has recently developed a body of bessemer ore, two miles west of the Heidelbach land near the village of Palmer; the ore at this mine is of the soft, greasy texture which characterizes the ores of the Swanzy range. The exploratory work on the Heidelbach land is under the charge of P. B. McDonald, and the contract for diamond drilling has been let to the Cole & McDonald Exploration Company.

Minnesota

Mississippi Mining Development—What is believed to be a good body of ore has been encountered at a depth of 103 ft. on this company's land in S. 23—T. 47—R. 29.

Helmer—It is reported that John Helmer, Duluth, has taken an option on 160 acres in S. 16—T. 46—R. 29, about one mile southwest of Ironton.

Mesabi Range

Virginia—This mine has closed down for the season and is the second mine of the Picands-Mather company to close recently.

Albany—This mine, also operated by the Picands-Mather company, will close down about Nov. 10 for the season. The company does not, however, expect to pull the pumps. The mine is an underground property and has employed about 200 men for the last few years.

Webb—Operations at this mine continue actively. At present the Gallagher Contracting Company is engaged in driving piles for the new coal trestle, which will be about 500 ft. long. The piers for the bents to the stock-pile trestle are in place and the American Bridge Company has a force of men on the ground.

Morton—This property is quite active as regards development work. Operations are being conducted on the first level and drifting to the orebody is in progress.

Oliver Iron Mining Company—The company has recently issued an order which is rather a new departure in this district. From now until the end of the season all the open pits will be test-pitted, in squares of 100 ft., in the ore. This will enable the determination of grades well in advance of shipping and will materially assist in grade reservations. It is expensive, but results are expected. The drill camps, which, until recently, have been situated at Keewatin, Minn., have been moved to Aurora, Minn., the drilling in the western Mesabi district being completed for this season. John Trebilcock, who has had charge of the work, will make his headquarters at Aurora. The Oliver, together with the contracting drill companies, will have about 150 drill crews on the eastern part of the range.

Missouri

Stokes-Shoemaker—A shaft is being sunk on this land, southeast of Joplin, on a drill hole showing 40 ft. of zinc ore which will run about 20 per cent. This is just south of the Bumble Bee mine.

Minor Heir Sunrise—The company has taken over the Sunrise mine, on the Allen land at Spring City, and is now draining the water from the mine. W. M. Sheridan, Chicago, is financing the work.

Kramer—This company has at last sold a portion of its pile of zinc ore, 500,000 lb. having been disposed of recently. The company has at least 3000 lb. still in the bins. There are three shafts and a slope, and preparations are now being made to sink a fourth shaft.

Bucyrus—The company has bought the Mercedes mill at Webb City and will move it to the mine.

Montana

Butte District

East Butte—The copper output was reduced 4 per cent. in the three months ended Sept. 30, as compared with the preceding quarter, and shipments to the smeltery were reduced 20 per cent. The copper contents of the ore shipped to the smeltery, also declined from 6 per cent. to 5.54 per cent. During the quarter 23,-723 tons of ore were mined, of which 16,158 tons were first-class ore, averaging 6.7 per cent. copper, and 7565 tons were second-class ore averaging 2.93 per cent. copper. Copper amounting to 2,787,023 lb. was shipped, from which 91,990 oz. of silver and 3450 oz. of gold were recovered. At the time that the company took over the Pittsmont mine and smeltery, on Oct. 1, 1909, an agreement was made between the two companies that the purchase price should be paid on or before Dec. 1, 1910, and as security for the deal the treasury stock of East Butte was placed in escrow with the Pittsmont securities; owing to depression in the copper industry a year ago, an extension of time to Dec. 1, 1911, was granted by the Pittsmont company, and as the copper situation still remains unchanged negotiations are under way for the postponing of the payment for another year, or until conditions are bettered.

Lincoln County

Snowshoe—The Pacific Coast Smelting, Refining and Mining Company, operating this mine south of Libby, has 1000 tons of concentrates awaiting shipment, as little hauling has been done there since the beginning of work last summer; regular shipments will be started in the near future. The company tried hauling the ore with motor trucks a short time ago, but it proved a failure, and horses will be used.

MADISON COUNTY

Gold Coin—The shaft on this property in the Rochester district has reached a depth of 360 ft., and is being sunk at the rate of 5 ft. per day, three shifts of men being employed. Ore was struck at a depth of 330 ft. and the shaft is still in the orebody, which averages from $30 to $50 per ton; a streak of high-grade, 8 in. wide at the depth of 360 ft., assayed about $200 per ton.

MISSOULA COUNTY

Kennedy Creek—This company, owning 400 acres of placer ground in the Nine-mile district, 30 miles west of Missoula, has finished the construction of a gold dredge for the property, and has commenced dredging. The company was organized in 1904 with a capitalization of $1,500,000, and tests were made of the whole area owned, with the result that 200 acres of it were proved to be profitable dredging land. The figures were presented to the California Dredging Company, of San Francisco, and that company took a 15-year lease on the property last April, the lease providing that a dredge be built and operated on a royalty basis. The newly finished dredge has capacity for handling 75,000 cu.yd. per month, and by the building of a ditch from Butler creek to the property, at a cost of $20,000, sufficient water can be furnished for all features of the operations. Winter quarters are being established by the company operating the dredge and it is planned to continue the work all winter.

Nevada

COMSTOCK LODE

Ophir—A dividend of 10c. per share was declared last week, being a disbursement to shareholders of $21,600, there being 216,000 shares in the company. This is dividend No. 34 and after being paid leaves a large surplus in the treasury. The company is now extracting ore at the rate of nearly $100,000 per month, the property being in fine physical condition down to the water level.

Mexican—A south drift has been started at the junction of the north and northeast drifts on the 2300 level and is giving ore averaging $20 per ton. This ore is being taken from what is known as the west fork of the main vein and is improving in grade as the drift is extended south. At the junction of the north and northeast drifts the ore assayed about $8 per ton. First-class ore is being run out from the 2500 stope for shipment to the smeltery.

Union Consolidated—The north drift on the 2500-ft. level has given ore averaging $16 per ton. From the end of the drift a west crosscut has been driven to the footwall of the formation, showing the vein to be between 20 and 30 ft. wide in that direction. There are rich stringers running through the porphyry and now that the footwall has been reached, it is proposed to follow the stringers northerly. The ore strongly resembles that in the Mexican. The face of the north drift is now only 90 ft. north of the south boundary line of the mine and as the claim is 600 ft. in width, the possibilities of the virgin ground ahead are considered favorable. The mine on this level is worked from the Mexican side.

Con Virginia—The vein being followed on the 2550 level from the Ophir side has widened to nearly 7 ft. The material is solid quartz with improving ore coming in on the east side.

Crown Point—Another run has been started at the Yellow Jacket mill, the ore recovery for the last three weeks having averaged in excess of 500 tons per week.

ESMERALDA COUNTY

Goldfield Consolidated—Telegraphic advices state that the estimated production for October is 30,626 tons; gross value, $805,000; operating expenses, $205,000; net profits, $600,000.

HUMBOLDT COUNTY

Indian Consolidated Mining Company—This is a new company, formed to operate in Limerick cañon, near Lovelocks. The capitalization is $5,000,000. Sol. Camp is manager, and John G. Kirchen, Tonopah, is consulting engineer.

NYE COUNTY

Halifax—A large shaft is being sunk to encounter the extension of the Tonopah-Belmont orebodies.

Tonopah-Belmont—An auxiliary electric hoist has been installed on the 1286-ft. level and the sinking of the main shaft has been resumed. The winze from this level is now 85 ft. deep on the dip of the orebody, carrying good ore across a width of 7 ft. The flow of water is about 50 gal. per minute.

New Mexico

A complete and detailed survey of a region about 14 miles square, surrounding Raton, Colfax county, is now in progress by a corps under R. B. Robertson, who will make the triangulation of the field. He is now awaiting the arrival of a topographer, who will map the mining district in this vicinity.

Philadelphia—It is reported that a mill is to be installed at this mine in the Organ district. Considerable development work is being done and sinking of an 800-ft. shaft is expected to start soon.

Bennett-Stevenson—Extensive development operations are soon to commence. The shaft will probably be sunk 200 ft. deeper and it is stated that more machinery will be added to the present 300-ton mill, with a view of increasing the output.

Doña Dora—The company is expected to install a reduction mill at its property near Kent, Doña Ana county. The mine is reported to have developed a good-sized body of silver-lead ore.

Deadwood—Extensive development combined with the regular mill tonnage is taxing the capacity of the present hoist to the utmost; during this development period the management has decided to devote a portion of the mill to the treating of custom ores.

Oklahoma

A recent decision of the Circuit Court of Appeals, given at St. Paul, Minn., declares that the Indians have no right to sell their mineral lands in and about Miami.

Swastika—Drilling on this property has shown 8 ft. of ore below the level of the old drifts. This was the southernmost of the mines at Miami.

Oregon

LANE COUNTY

West Coast Mines Company—Gold amounting to $14,000 in 60 days was caught on the plates at the Champion mill in the Bohemia district. The mill is kept busy night and day.

Treasure—This mine in the Blue River district will soon be put in operation. Some ore is blocked out and ready to run through the mill. Over $150,000 have been spent on this property in development work and equipment.

Blue Bird—The new mill that was recently started on this property has been shut down because the gold could not be saved on the plates, it being rusty and requiring a roaster, which will be installed soon.

South Dakota

BLACK HILLS DISTRICT

Homestake—Work is progressing rapidly on construction of the pole line between the hydroelectric plant on Spearfish creek and the distributing station at Lead. The distance is 12 miles, by the survey, over a rough portion of the Black hills. Idaho cedar poles are being used, 40, 45 and 50 ft. in length. The sub-station at Lead, which is being constructed of reinforced concrete, is well under way.

Evans Consolidated—This company has purchased the mill site and mill formerly belonging to the Lexington Hill company. The plant has 20 stamps and a cyanide annex. A crew of men is at work making the necessary repairs and alterations in order to put the plant in commission. Electric power is to be installed throughout. A body of porphyry ore carrying good gold content was recently encountered. O. N. Brown, Deadwood, is general manager.

Jungle—Development work on this copper prospect is being prosecuted steadily with encouraging results. J. H. O'Brien, Deadwood, is general manager.

Minnesota Mines Company—The real and personal property of this company has been sold to satisfy labor leins and other indebtedness to the amount of $18,700. The mill, which is a wet-crushing, cyanide mill, is one of the best in the district and uses two Lane slow-speed chilean mills for grinding. The property is worth much more than the judgment and will undoubtedly be redeemed by the stockholders.

Victoria Extension—Shipments of high-grade gold ore are being made to outside smelteries. The ore occurs in a limestone formation and is rather irregular. A. J. Malterner, Deadwood, is manager.

Utah

Beaver County

Indian Queen—Ore has been opened by leasers at five points between the surface and to a depth of 225 ft. Shipments of good grade are being made.

Majestic—Two cars of silver-lead ore from the 500-ft. level, the last shipment from which brought $19 per ton, are ready for the market. The water level has been found here and pumping equipment will be installed. Copper ore has been opened in other parts of the property. The report that this company's Harrington-Hickory mine has been closed down are officially denied. Conditions are stated to be improving, and arrangements for more active development are being made. It is understood that electricity supplied directly to the pump equipment will take the place of compressed air.

Bradshaw Mining Company—The Bradshaw Mining and Milling Company has reorganized under the above name. A. P. Allen is president. The property, consisting of eight claims a few miles from Milford, will be surveyed for patent at once. Mining at depth is planned, to reach the junction of fissure veins shown on surface.

Noonday—This company owns four claims seven miles east of Milford, adjoining the Cave property which has produced in the past. Two 40-ft. shafts have been sunk on a vein of iron ore about 1500 ft. from the Cave's productive workings. In one shaft there is 4 ft. of ore carrying $6 in gold, and a little silver, with a large excess of iron. A 1-ft. streak of lead carbonates parallels the vein of iron ore. A new hoist has been completed, and buildings are being erected. The company is financed by Minneapolis and Los Angeles men.

Moscow—Steady shipments, averaging $1500 per car, are being made.

Red Warrior—This company is shipping. A 3-ft. vein of high-grade lead ore has been opened on the tunnel level.

Rob Roy—It is reported that 22 tons of ore running $220 per ton have been mined recently; work is being done on the 200-ft. level. Some ore of higher grade has been sacked and a shipment is under way. The company hauls to the railroad at Milford, a distance of 30 miles.

Juab County

May Day—Gold ore has recently been developed. A 25-ton car from the Buckley lease on the 400-ft. level averaged about $50 per ton. The ore carried $7 in gold, 64.8 oz. silver, and 18 per cent. lead. More of this ore is in sight and further shipments will probably be made.

Dragon Iron—The drift from the 800-ft. level of the Iron Blossom No. 1 shaft, is following the vein; the drift and a raise extended 80 ft. above the level have cut a large amount of ore carrying $6 in gold, copper and silver.

Sioux Consolidated—Low-grade ore has been found in the raise from the 600-ft. level, and in the main drift on the same level. The usual shipments are being made. Conditions are reported satisfactory.

Beck Tunnel—There is about 6 ft. of lead ore in the face of the south drift of the tunnel.

Eagle & Blue Bell—A winze has been sunk from the 1200- to a point a short distance below the 1300-ft. level, from which point a drift has been driven following the ore for 150 ft. The orebody is rich and there are indications that it continues to greater depth. The company is earning a good profit.

Yankee—The expenses of development at depth are being paid for from the sale of dump ore, 120 to 130 tons of which are being shipped per day. Work is being done on the 1700-, 1900- and 2000-ft. levels, indications on the 1700 being especially encouraging.

Colorado—A drift is being driven on the 300-ft. level in search of the continuation of the orebody on the 250-ft. There is reported to be $140,000 in the treasury.

Iron Blossom—The drift on the 600-ft. level of No. 3 shaft is being driven to encounter the orebody opened in a cave on the 500-ft. level. Eighty tons per day are being shipped from the No. 3 workings.

Summit County

Silver King Consolidated—Ore about 10 ft. wide with a high-grade streak 3 ft. wide, has been opened in a drift from the three-compartment raise above the tunnel level. The orebody has been followed 50 ft. on its strike, and is making off into the limestone bedding. The same orebody has been broken into on the 1550 level, 40 ft. below. Various raises from the latter level have proven ore for several hundred feet.

Washington

As the result of an investigation by C. E. Hard, mining engineer, of San Francisco, work will soon be started on a tramway to connect the Bellingham Bay & British Columbia railway with the coal deposits at Glacier, and with the completion of this tram shipments can be made promptly.

Surprise—Preparations are being made to deepen the shaft on this property in order to obtain better ventilation. The mine is at Republic, Ferry county.

Napoleon—The process of saving gold at this mine at Orient is to be changed from the cyanidation to the amalgamating process, and the capacity of the mill will be increased.

Kettle River—Operations at this property in Ferry county have been resumed, under W. S. Bliss, Orient, and work will be done on a larger scale. The tunnel is to be deepened.

Mogul F—Plans are being made for enlarged operations on this propery in Ferry county and include a 100-ft. tunnel. The ore contains gold and copper. E. W. Scothern, Orient, has charge.

Pacific Mining and Smelting—This company, under the management of Wilbur Hosea, Chewelah, expects to be able soon to make regular shipments. The shaft is down 50 ft., and is in ore.

Wisconsin

American Zinc Ore Separating Company—The separating mill at Platteville, recently destroyed by fire, will be rebuilt.

Quinlon—This old mine, at Benton, is being reopened by a new shaft, as drilling found some promising ore. This was a large, profitable producer from the "glass-rock" horizon about 30 years ago.

Sluffer Mining Company—This company, which leased the Pittsburgh-Benton mine for a year at 20 per cent. royalty, has surrendered the lease after paying dividends of $1000 per share. The subscribers bought the stock originally for $50.

Vinegar Hill—The company is equipping the Rowley mine with a new plant and is operating the Vinegar Hill, Unity and Winshell mines. The latter is a new property that the company has taken over and is a good producer; recently 75 tons of concentrates were produced in one shift.

Etna—The mine, at Benton, is being worked under lease as the Ewing mine, and is opening up some fine bodies of dry bone and jack.

Haskins—The mine, at Hazel Green, one of the oldest in the district, has made a new strike. It is now owned by the New Jersey Zinc Company, that has also acquired the Rajah mine, at Linden, for $40,000.

Instate Power—The company is extending the transmission line into the Shullsburg district.

Canada

British Columbia

It is reported that the coal strike that has been in progress for many months has been settled and that all mines will again be in operation in a few days.

A Salt Lake syndicate is reported to have bonded a property on Juniper creek, lying between Nine Mile and Hazelton. Development has started and a compressor plant and other machinery will be installed in the spring.

British Columbia Copper—The company is reported to have bonded the Voight group of claims on Copper mountain, near Princeton.

Northern Terminus—This mine in the Portland Canal district has resumed sinking its inclined shaft and is reported to be developing good silver ore.

Noble Five—At the mine in the Cady section of the Slocan district, both silver-lead and silver-zinc ore are said to have been developed in considerable quantity during recent months.

Sullivan—A large amount of development work is being done at this mine of the Canadian Consolidated company in east Kootenay. A concrete dam is being constructed on Mark creek and a pipe line, a mile in length, is being laid to connect with the compressor and electric plant at the ore bins. New bins and sorting plant are also under construction. About 125 men are employed.

Standard—Eight feet of clean ore is reported in the No. 6 level of this mine at Silverton.

Ontario—Cobalt

Cobalt shipments for the week ended Nov. 3 were as follows: McKinley Darragh, 202,700 lbs.; Coniagas, 188,320; La Rose, 144,800; Temiskaming, 138,720; Cobalt Townsite, 117,080; Cobalt Lake, 114,420; Chambers-Ferland, 64,000; Kerr Lake, 61,000; Drummond, 60,000; Nipissing, 58,080; Crown Reserve, 51,080; Trethewey, 41,600; total, 1,251,880 pounds.

King Edward—The 10-stamp mill has been leased by the City of Cobalt mine. The milling ore from the City of Cobalt was formerly handled by the Northern Customs Concentrator. Last summer the contract expired and was not renewed. The King Edward mill was built three years ago and has been closed since last winter.

Seneca Superior—The Kerry leases, on Peterson lake, have been taken over by this company and it is expected that operations will be resumed soon. The Kerry has been closed down since last spring.

Nipissing—The company is erecting a large shafthouse at the Meyer shaft. A sorting and jigging plant similar to that at the Kendall, is also being installed. About two years ago the Meyer and Fourth of July vein to the south were connected by a crosscut on the first level and last summer connection was made between the Meyer and the Number 64 vein to the north on the second level. When construction is completed, ore from all three veins will be handled through the Meyer shaft and treated at the central sorting plant.

Cobalt Lake—A large quantity of ore running about 200 oz. of silver per ton has been taken out of a vein, found at the 160-ft. level, about 100 ft. from shaft No. 4. The mill is running continuously, treating about 75 tons per day. All ore shipped this year has been low grade.

Hitchcock—An initial shipment of 10 tons of silver ore has been made from this property, at Elk lake, to the new smeltery at Latchford.

Ontario—Porcupine

Hughes—Work is to be started on this property, which has lately been acquired by Montreal men. A large vein has been opened up and a small plant will be installed to carry on sinking operations.

Brydges—This company will coöperate with the Preston East Dome in opening up the new vein found at the boundary of the two properties.

Foley-O'Brian—The stock records show that five people own 358,825 shares of this stock and the general public owns only 141,175 shares.

Porcupine Reserve—The main shaft is being put down on a formation 75 ft. wide, of quartz and schist carrying gold. It will be sunk to the 100-ft. level and crosscutting undertaken.

West Dome—Three shafts are being sunk. The main one has reached a depth of 125 ft., and crosscutting is proceeding. Another shaft, near the west end of the property, is down 30 ft., and the third has been started near the middle of the ridge.

Porcupine Gold Mines—The main shaft is down 200 ft., and crosscutting is being done north to No. 2 vein and south to No. 3. The 100-ton mill is expected to be ready for operation in February.

McIntyre—It is stated that silver has been taken from the bottom of the main shaft, being sprinkled in the quartz along with sprinklings of gold. This is regarded as an indication favorable to the occurrence of gold at greater depth.

Rea—The main vein has been cut at the 300-ft. level. A number of outcroppings showing visible gold have been found on the surface and are supposed to belong to one vein, extending for at least 600 feet.

Jupiter—Drifting has been done for 84 ft. from No. 1 shaft at the 100-ft. level and the vein found to carry good contents. Crosscutting the No. 3 vein at 100 ft. shows it to be 21 ft. wide at this depth and yielding good ore.

Scottish Ontario—Surface work is being continued until the new company is ready to take over the property. A new vein coming in from the Daly-Taylor to the south is being opened. Pannings taken from a 3-ft. vein show free gold.

Mexico

Chihuahua

La Virgen—This mine in the Placer de Guadalupe district in the municipality of Aldama is being developed. A shaft has been sunk to water level under the direction of the manager, Charles Seawell.

Jalisco

Mololoa—A party of 26 men from the United States is now visiting the Mololoa, El Favor and Mirador mines in the Hostotipaquillo district, and the Tajo mines in the San Sebastian district. There are five faces in the mine producing bonanza ore which is being sacked and shipped to the smeltery.

Pan-American Investment Company—The concentrating plant at this mine in the Amatlan de Cañas district of Tepic, has been completed and soon will be operating steadily. The company expects to ship about 50 tons of concentrates per month. Walter Foster and E. M. Browder are in charge.

Hidalgo

Compañia Explotadora de Minas—This Pachuca company will start the construction of a mill and cyanide plant for the treatment of the ore from its mines. This company was formerly known as the Andres Tello company; it owns a number of properties in the Pachuca and El Chico districts, the principal one being El Bordo mine. The low-grade ore from this property has formerly been treated in La Luz custom mill, operated by the Blaisdell Coscotitlan Syndicate.

Sonora

Penn-Sonora—This property, a short distance from Nogales, is to be equipped with a 100-ton electrostatic plant and also a power line. The electrostatic plant will be built at Aguacaliente. C. W. Phillips is in charge.

Oro Colorado—This mine, 12 miles south of the Penn-Sonora, is owned by Rhode Island men. It is reported that a 20-stamp mill and cyanide plant will be built.

Lampazos—It is announced that within the next six months work will be started at this property, south of Montezuma.

Asia

Chosen

Oriental Consolidated—During August 30,470 tons were crushed, yielding $126,358 gross, and net, $51,802. Operating expenses were $71,924, and $2631 was expended for improvements.

The Markets

Coal Trade Review

New York, Nov. 8—Little change is apparent in the coal markets. In the West a spell of cold weather has stimulated business to some extent. The quickness with which demand responds to weather changes is a pretty sure sign that stocks in consumers' hands are generally small, as has been pointed out from time to time.

Coal is still going to the Lakes for shipment, and it is certain that this season will show pretty large totals.

The seaboard bituminous trade is improving a little and the demand for steam coal is better than it has been. The coastwise trade has had a spurt, owing to the belated demand for the shoalwater ports.

Anthracite trade is steady. There is in this trade also an increasing demand for coastwise shipments, which is taking all the available coal.

Foreign Trade—Exports of fuel from the United States, nine months ended Sept. 30: Anthracite, 2,625,582; bituminous, 10,124,872; coke, 722,721; bituminous furnished to steamships in foreign trade, 5,001,151; total, 18,474,326 long tons. This is an increase of 2,588,958 tons, or 16.3 per cent., over last year. Canada took this year 10,244,516 tons of coal, or 80.3 per cent. of the exports.

Imports into the United States for the nine months were: Bituminous coal, 928,311; coke 55,958; total, 984,269 long tons, a decrease of 579,452 tons, or 38.4 per cent. from last year. Canada furnished this year 753,050 tons of coal and nearly all the coke; Australia, 160,423 tons of coal. Anthracite imports were only 20 tons this year.

IRON·TRADE·REVIEW

New York, Nov. 8—The sentimental effect on the market of the Government suit against the Steel Corporation is gradually passing over. Just how much effect it has had on the market is hard to tell, and opinions differ widely on this point. One thing seems certain, and that is that no more efforts will be made to control prices, and that business will continue to be done under sharp competition and at low prices. Conditions have not changed, and while the volume of trade is large, orders are still chiefly for early delivery and long contracts are the exception.

In finished materials there is an active business in bars, sheets and plates. In structural steel some big contracts are forward. The American Bridge Company has taken the contract for the bridge over the East river at New York for the New York Connecting Railroad, which is to join the Pennsylvania and New Haven roads. This contract will take about 35,000 tons of steel; and other contracts are to be let soon for the same line, which will take about 30,000 tons more.

Current Prices of Metal, Minerals, Coal and Stocks, Conditions and Commercial Statistics

Railroad-equipment orders are beginning to come out more freely, and there are signs that the railroads will soon be more active in the market. The Burlington road is inquiring for 20,000 tons of openhearth-steel rails; inquiries from other roads amounting to 100,000 tons are noted.

Pig iron has been quiet, and not many new orders have been placed. There seems to be some expectation of lower prices for ore, based partly on the reduction of rates on the Minnesota railroads. The new rates went into effect Nov. 1, too late to affect shipments this season. Indeed the effect will not be felt until well on in next year. Nevertheless, the reduction is being urged as a reason for lower prices, and buyers are not sure yet that quotations have touched bottom.

Baltimore

Nov. 6—Exports for the week included 66,940 lb. zinc dross and 2,820,800 lb. steel billets to Liverpool. Imports included 5300 tons iron ore from Cuba.

Birmingham

Nov. 6—Southern manufacturers of pig iron are still selling iron, some for immediate delivery and some for delivery during the first six months of the comng year. The iron quotations are around $10 per ton, No. 2 foundry. The manufacturers are still depressed over conditions. An inventory being taken this week of the warrant and furnace yards will show, it is believed, a small reduction again in the stocks on hand.

The Birmingham district is showing interest in two mergers, one of which was consummated during the past week, whereby the Woodward Iron Company purchased the properties of the Birmingham Coal and Iron Company, including 40,000 acres of coal land, two furnaces, ore lands and the exclusive trackage rights on a railroad between Mulga and Woodward. The Birmingham Coal and Iron Company owns the Mulga mines, which are claimed to be the best equipped in the United States. The other merger is that between the Alabama Consolidated Coal and Iron Company and the Southern Iron and Steel Company, the concluding negotiations to be handled in New York this week.

Though there is a little scarcity of orders for rails, the general steel conditions in this district are still fairly good. There is a healthy shipment of steel-wire goods from the Gadsden plant of the Southern company.

The scrap-iron trade is dull. The charcoal-iron demand is only fairly good, considering the average make in this section.

Chicago

Nov. 6—The iron market continues dull. No perceptible influence seems to be directly traceable to the effect on the market of the suit against the Steel Corporation, but doubtless it has been a cause of the prevalent feeling of uncertainty. Melters of pig iron—who make this market chiefly—refuse to buy extensively. They say that the market is uncertain, that the prospects are doubtful, and the tendencies are altogether downward. They are right in a sense—the conditions are depressing. Buyers and sellers are holding off, to see what developments may be. Under these circumstances quotations remain as last week: Southern No. 2 brings $10, Birmingham, or $14.30, Chicago, and Northern No. 2 is worth $14.50, local furnace minimum. Lake Superior charcoal brings $16, with the supply small.

As regards finished products, the tendency also is to wait. The great buying agencies are able to wait; the smaller users must do so. Building operations are quiescent; railroad buying depends largely on actual needs. Sales of rails and track supplies are few. The battle continues around steel bars—the local price is lower than the Pittsburg price, yet in exceptional cases—because of the activity of local mills and their storage possibilities. For plates, sheets and wire products the market continues fair to good, with every buyer in a waiting attitude.

Cleveland

Nov. 6—Shipments of ore are dragging. There is beginning to be talk of prices for next season, but no one has any definite idea so far, except that the reduction in rates ought to show somewhere.

Pig Iron—Orders are rather slow, but contract deliveries are being taken more freely. Quotations are weaker. Prices,

Cleveland delivery, are $15.15 for bessemer, $13.25 for No. 2 foundry, $12.50 for gray forge and $17 for Lake Superior charcoal.

Finished Material—Rather a quiet week. Most business done is in bars and plates. Prices are a little steadier.

Philadelphia

Nov. 8—The pig-iron market is being further seriously disturbed by reason of the uncertain cost of next year's production due to lower cost of ore and freight rates. Several negotiations started two or three weeks ago are held up and prospective buyers are delaying further action. Basic and bessemer are both affected. Inquiries for the past week referred particularly to No. 2 foundry. Buyers have very little in the yards. Southern makers are again renewing offers for next quarter's delivery and it is worth noting that the latest quotations are shadings. Buyers in this territory are encouraged to believe that their general holding back will result in still further reductions. No further large transactions are looked for in basic pig, as consumers are also in a position to delay for some time. Best quotations are $15 for No. 2 X foundry, $14.50 for gray forge with a difference of about 25c. in southern brands.

Steel Billets—Like some other consumers the buyers of steel billets are pursuing a hand-to-mouth policy and feel they have been rewarded for their course. The limit, however, has been probably reached. Openhearth billets are $21.40; forging billets, $26 minimum.

Bars—The general situation is being improved by the activity in car building. The inquiries for the past week point more definitely than for some time to large orders from this source. Most of the bar-mill business is done at firm prices, but the larger business now in sight can be had only at concessions which makers are willing to extend.

Sheets—The sheet mills report a still further improvement, but it is confined almost exclusively to small orders.

Pipes and Tubes—Tube work maintains an even course. Merchant pipe is strong at card rates, but new business which was promising a week or two ago is still hanging fire.

Plates—The outlook for plates is better than it has been for some months. Quite a batch have come in within a week from shipyards, bridge builders and others. Quotations range from 1.35 to 1.40c., with a strong probability that 1.30c. will be final figure for ordinary plates.

Structural Material—The placing of extensive orders connected with New York enterprises and of some encouraging orders from shipyards and the assurance of more big orders, many of them for winter delivery, have hardened a tone which is suggestive of old-time activity. The smaller buyers are chasing in a good deal of business for small lots.

Scrap—The scrap market has not gathered any life and the large stocks in hand and small current sales point to the probability of concessions.

Pittsburg

Nov. 7—There are some cross currents in sentiment in the iron and steel market, which is encouraging from the fact that hitherto sentiment has been uniformly unfavorable. In some quarters decidedly hopeful feelings are expressed, but so far as can be ascertained, these feelings rest upon theory only. It is urged, for instance, that the time is ripe for the railroads to make important improvements, there having been more than four years of greatly curtailed buying, while present prices are extremely attractive. Stocks of steel in the hands of jobbers and manufacturing consumers are at an unparalleled low level, and it has been the repeated experience of the iron and steel market that if it once starts upon an improvement it rides rough shod over all sentimental obstacles.

The market on wire products has declined another dollar a ton, following the drop of a fotnight ago, and $1.55 on nails and 1.35c. on plain wire can be done, although the quotations are usually not made openly.

Most of the steel interests have found their October bookings slightly in excess of those in September, but in the majority of cases they fell behind the output, which showed a slight increase in October.

Steel products are now at an average level $5 a net ton below those of May 1, which were slightly higher than at the beginning of the year, while they are $11 a ton below those of November, 1907. A point has been reached where the earnings even of the best positioned producers are meager and no important further declines can occur without visiting hardship upon at least some of the competitors. The matter of reducing wages is not being seriously considered. Apart from the influence of the leading interest, which was strongly exerted against such a move when it was first suggested two or three months ago, is the recognition that labor on the whole is far from plentiful, and that it is in a very nervous and excitable frame of mind.

Pig Iron—The market in the past week has been unusually quiet, even for these times, there being some days on which important sales offices did not have a single inquiry. A feature of the situation is the practical absence of stocks of foundry iron at the merchant furnaces in western Pennsylvania and the Mahoning valley, this arising through a long course of liquidation during which very few furnaces were producing. The few furnaces now in operation have a comfortable trade and are not piling any iron, so that the statistical position of foundry iron is good. Not as much can be said of basic and bessemer, of which there are considerable stocks. The pig-iron averages, compiled by a leading interest in the trade from actual sales, are announced for October at $14.5375 for bessemer and $12.515 for basic, f.o.b. Valley furnaces. We continue to quote: Bessemer, $14.25; basic, $12.50; malleable, $12.50@12.75; No. 2 foundry, $13.25@13.50; forge, $12.75@13, f.o.b. Valley furnaces, 90c. higher delivered Pittsburg.

Ferromanganese—The market in ferromanganese has been the most inactive seen in a long time, sellers holding to the $38.50, Baltimore, price, which the English combination dictates, while buyers have been holding aloof in order to postpone their purchases to the last moment. In territory outside Pittsburg a few sales have been made at less than $38.50, and the belief in some quarters is that the sellers went short on these transactions. The market is quotable nominally at $38.50, f.o.b. Baltimore.

Steel—Most of the bessemer sheet-bar tonnage for November on regular contracts has been settled on the basis mentioned in last report, $20, f.o.b. the respective mills in Ohio, or delivered Pittsburg. No important sales have been made of either billets or sheet bars. We quote billets and sheet bars, bessemer and openhearth, at $20, Pittsburg.

Sheets—The volume of business is substantially unchanged, being equal to about 70 per cent. of the total mill capacity. Prices are not quotably changed, but there is a little more irregularity in black sheets, reports being more frequent of 1.80c., f.o.b. Ohio mill, being done on 28-gage black. Such transactions are still regarded as exceptional, the open-market quotation being 1.85c. at Ohio mill, with 2.90c. on galvanized. The high price of spelter, 6.10c., East St. Louis, adds greatly to the cost of making galvanized sheets, and while the spread between black and galvanized sheets is 5c. per 100 lb. more than it was a few months ago, the increase is not sufficient to cover the increased cost of manufacture. We quote the open market at 1.85c. on black, 2.90c. on galvanized, 1.40c. on blue annealed, 10 gage, $1.35 per square on painted corrugated and $2.50 on galvanized corrugated, f.o.b. mill, Ohio, with occasional shading on flat sheets and frequent shading on corrugated.

St. Louis

Nov. 6—The market shows little change and demand continues light. Producers have come to the conclusion that there will be no chance to advance prices under present conditions and consequently are extending the $10 price, f.o.b., Birmingham, to cover deliveries well into next year. Some fair-sized inquiries have

been received for first-quarter delivery, though the spot market is unusually dull. Northern malleable is also weak with light demand. The price on Northern iron remains about $14.25. Southern iron is bringing $10, Birmingham, or $13.75, St. Louis, for No. 2 foundry. Foundries and melters are well supplied with iron and a number of them have stocks on hand to run up to next April under the present conditions. The demand for finished products is light and the railroads are buying the minimum.

Iron Ore Trade

Imports and exports of iron ore in the United States, nine months ended Sept. 30, long tons:

	1910	1911	Changes
Imports	1,999,917	1,362,352	D. 637,565
Exports	545,282	579,538	I. 34,256

Imports this year included 855,959 tons from Cuba, 164,662 from Spain, 153,162 from Sweden, 130,280 from Newfoundland, 39,754 from Canada and 48,535 tons from other countries.

Imports of manganese ore for the nine months were 183,315 tons in 1910, and 134,645 in 1911; decrease, 48,670 tons.

It is estimated that contracts have been closed for about 500,000 tons of Swedish iron ore for the United States in 1912. This includes the big contract of the Bethlehem Steel Company. These ores are high grade, running over 65 per cent. iron, and low in phosphorus. Prices for these ores are about 8c. per unit, delivered at Philadelphia.

METAL MARKETS

New York, Nov. 8—The metal markets have been rather irregular, but with some signs of a firmer tendency.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold:			
Sept. 1911..	$2,352,861	$ 4,704,096	Imp.$ 2,351,235
" 1910..	1,822,476	3,192,341	Exp. 1,269,865
Year 1911..	18,263,310	45,177,106	Imp. 26,913,796
" 1910..	55,318,081	45,682,127	Exp. 9,635,954
Silver:			
Sept. 1911..	4,941,391	4,161,706	Exp. 779,685
" 1910..	4,830,346	3,441,494	Exp. 1,388,852
Year 1911..	49,528,961	33,696,430	Exp. 15,832,531
" 1910..	41,764,743	33,257,264	Exp. 8,507,479

Exports from the port of New York, week ended Nov. 4: Gold, $437,378, chiefly to Brazil and Panama; silver, $1,021,005, principally to Paris and London. Imports: Gold, $455,227; silver, $220,974, both chiefly from Mexico and South America.

Gold—Prices remained on the usual level on the open market in London, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coins. Paris is still taking some gold.

Sales of gold bars from the U. S. Assay Office in New York in October amounted to $5,120,055, of which $2,078,500 were for export. For the 10 months ended Oct. 31, the total sales were $27,992,697, an increase of $6,580,880 over last year.

The Treasury Department estimates gold in the United States, Nov. 1, as follows: In Treasury against gold certificates, $997,062,669; in Treasury current balances, $200,079,770; in banks and circulation, $594,417,161; total, $1,791,559,600, being an increase of $8,795,625 during October.

Platinum—The market is quiet, but steady, and there is no change in prices. Dealers ask $46@46.50 per oz. for refined platinum and $48.50@49 for hard metal.

Our Russian correspondent writes, under date of Oct. 26, that the market is firm. Mining works are at an end for the season. From Ekaterinburg it is reported the production of this year is a little less than that of 1910. The prices remain generally unchanged. Crude metal, 83 per cent. platinum, is quoted, at Ekaterinburg, 10.05 rubles per zolotnik. For St. Petersburg, 38.500 rubles per pood—equivalent to $37.79 and $37.73 per oz., respectively.

Iridium—Prices are off a little, at $64 per oz. for pure metal.

Silver—The market is in the hands of speculators, who have taken advantage of a condition created by the disarrangement of affairs in China, and the scarcity of spot silver to advance the price.

SILVER AND STERLING EXCHANGE

Nov.	2	3	4	6	7	8
New York....	54⅜	54⅜	54¼	54¼	....	55
London	25 1/16	25 1/16	25	25	25¼	25
Sterling Ex..	4.8680	4.8690	4.8695	4.8690	....	4.8695

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Shipments of silver from London to the East, Jan. 1 to Oct. 26, reported by Messrs. Pixley & Abell:

	1910	1911	Changes
India	£5,595,500	£7,275,600	I. £1,680,100
China	1,143,500	989,700	D. 153,800
Total	£6,739,000	£8,265,300	I. £1,526,300

India Council bills in London brought an average for the week of 16.06d. per rupee.

Foreign trade of the United States, nine months ended Sept. 30, as valued by the Bureau of Statistics, Department of Commerce and Labor:

Merchandise:	1910	1911
Exports	$1,222,926,758	$1,455,474,289
Imports	1,172,362,409	1,133,002,284
Excess, exports	$50,564,349	$ 322,472,005
Add excess of exports, silver		15 832,531
Total		$ 338,304,536
Deduct excess of imports, gold		26,913,796
Net export balance		$ 311,390,740

The gold and silver movement in detail will be found in the table at the head of this column.

Exports of silver through the port of San Francisco, nine months ended Sept. 30, were $7,221,458, of which a total of $7,002,372 was in bullion.

Copper, Tin, Lead and Zinc

NEW YORK

Nov.	Copper: Lake, Cts. per lb.	Copper: Electrolytic, Cts. per lb.	Tin: Cts. per lb.	Lead: New York, Cts. per lb.	Lead: St. Louis, Cts. per lb.	Zinc: New York, Cts. per lb.	Zinc: St. Louis, Cts. per lb.
2	12⅜ @12⅝	12.25 @12.30	42	4.20 @4.25	4.10 @4.12½	6.15 @6.25	6.00 @6.10
3	12⅜ @12⅝	12.25 @12.30	42	4.20 @4.25	4.10 @4.12½	6.15 @6.25	6.00 @6.10
4	12⅜ @12½	12.25 @12.30	42	4.20 @4.25	4.10 @4.12½	6.15 @6.25	6.00 @6.10
6	12⅜ @12⅝	12 30 @12.35	42⅛	4 20 @4.25	4.10 @4.12½	6.15 @6.25	6.00 @6.10
7	.....	.....	....	.....	4.10 @4.12½	.....	6.00 @6.10
8	12⅜ @12⅝	12.30 @12.35	42¼	4.20 @4.25	4.10 @4.12½	6.15 @6.25	6.00 @6.10

The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis New York, cash. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Nov.	Copper: Spot	Copper: 3 Mos	Copper: Best Sel'td	Tin: Spot	Tin: 3 Mos	Lead, Spanish	Zinc, Ordinaries
2	55¾	56⅛	60	187⅛	184⅜	15⅛	26¾
3	55 11/16	56 1/16	60	186¼	183½	15 9/16	26¾
4	.....	.....	.....	.....	.....	.....	.....
6	55 13/16	56 11/16	60	189⅜	186½	15⅞	26¾
7	56	56¾	60	189	185¾	15 13/16	26⅝
8	56⅛	56⅞	60	191⅛	185⅞	15 13/16	26¾

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £12 = 2.61c.; £23 = 5c.; £60 = 13.40c. ± £1 = ± 0.21¾c.

Copper—If there were still existing any of the apprehensions which were generally expressed recently regarding a prospective contraction in the foreign consumption of copper, they must have been dissipated during this week. The demand for export was very heavy and a large business took place at advancing quotations. Domestic consumers have not taken much interest in the market, and there appears to be an inclination to await the effect of the statistics. The close is firm at 12⅜@12⅝c. for Lake copper, and 12.30@12.35c. for electrolytic copper in cakes, wirebars and ingots. Casting copper is quoted nominally at 12 to 12¼ cents.

The standard market reflected the ac-

tive business which took place in Europe, advancing steadily from day to day, there being very little inclination on part of holders to meet current quotations. The close is firm at £56 2s. 6d. for spot, and £56 17s. 6d. for three months.

Copper sheets are 18@19c. base, for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 13½c. base, carload lots at mill. Business is quiet.

Exports of copper from New York for the week were 5291 long tons. Our special correspondent gives the exports from Baltimore at 1979 tons.

Visible stocks of copper in Europe on Oct. 31 are reported as follows: In England, 48,160 long tons; France, 5700; afloat from Chile, 2080; afloat from Australia, 5900; in Rotterdam, 6900; in Hamburg, 10,200; total, 78,940 tons, a decrease of 3380 tons from the Oct. 15 report.

Tin—A good business was done in this market among both dealers and consumers, the former buying mostly for January delivery, while the latter are still restricting their purchases to spot tin. Stocks in this market are decreasing, and as they are held by only a few concerns, a premium for spot material seems to be imminent. At this writing, November tin is being quoted at about 42¼c. per pound.

The London market recorded quite an advance over last week, but developed again considerable backwardation for three months' tin. The close is firm at £191 5s. for spot, and £185 10s. for three months.

Arrivals of Bolivian tin and tin concentrates in England in October were 1947 tons, making a total of 19,337 tons for the 10 months ended Oct. 31, an increase of 4682 tons over last year.

Visible stocks of tin on Oct. 31 are reported as follows: London, 10,683; Holland, 746; United States, excluding Pacific ports, 2732; total, 14,161 long tons, a decrease of 2511 tons from the Sept. 30 report.

Lead—The lead market is unchanged at 4.10@4.12½c., St. Louis, and 4.20@4.25c., New York.

The London quotations are higher under the influence of a very heavy consumption and a great scarcity of near-by supplies. The close is strong at £15 18s. 9d. for Spanish lead, and £16 1s. 3d. for English.

Spelter—Excepting that the scarcity of November spelter is, if anything, even more acute than has been the case hitherto, there has been no material change in the position of the market, business being somewhat restricted on account of the disinclination on the part of consumers to anticipate their requirements. The close is firm at 6@6.10c. St. Louis, and 6.15@6.25c. New York.

The London market is somewhat higher, at £26 15s. for good ordinaries, and £27 for specials.

Zinc dust is quoted at 7½c. per lb., New York.

Base price of zinc sheets is $8 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Exports and imports of zinc in Germany, nine months ended Sept. 30, metric tons:

	Imports 1910	Imports 1911	Exports 1910	Exports 1911
Spelter	29,424	36,333	58,180	55,162
Zinc scrap	1,316	1,673	4,790	2,926
Zinc sheets	167	368	16.439	29,155
Zinc dust	1,047	640	2,234	2,338
Zinc paints	5,951	5,860	24,600	25,727

Imports of zinc ores, 174,732 tons in 1910, and 200,380 in 1911. Exports of ores, 42,718 tons in 1910, and 38,979 this year.

Other Metals

Aluminum—Business is fair and the market is firm, but with no quotable change. No. 1 ingots are 18.50@19c. per lb., New York. The market abroad is firmer than it has been.

Antimony—Business has dropped again and has been on a small scale. Cookson's is quoted at 8@8.12½c. per lb.; Hallett's, 7.60@7.85c.; while 6.95@7.25c. is asked for Hungarian, Chinese and other outside brands.

Quicksilver—Business is fair, but prices are unchanged. New York quotation is $45 per flask of 75 lb., with the usual advance for small quantities. San Francisco, $44.50 for domestic orders and $42 for export. London price is £8 10s. per flask, with £8 7s. 6d. quoted by second hands.

Imports and Exports of Metals

Exports and imports of metals in the United States, nine months ended Sept. 30, are reported as follows, in the measures usual in the trade:

Metals	Exports	Imports	Excess
Copper, long tons	264,605	115,918	Exp. 148,687
Copper, 1910	221,451	111,198	Exp. 110,253
Tin, long tons	920	37,796	Imp. 36,876
Tin, 1910	849	35,682	Imp. 34,833
Lead, short tons	78,830	68,314	Exp. 10,522
Lead, 1910	48,036	77,804	Imp. 29,768
Spelter, sh. tons	4,413	1,325	Exp. 3,088
Spelter, 1910	1,036	2,739	Imp. 1,703
Nickel, lb.	18,888,877	21,902,523	Imp. 3,013,646
Nickel, 1910	10,247,359	24,182,726	Imp. 13,935,367
Antimony, lb.	160,844	7,824,178	Imp. 7,663,332
Antimony, 1910	2,726	8,007,372	Imp. 8,004,646
Platinum, oz.	95	89,696	Imp. 89,601
Platinum, 1910	47	87,990	Imp. 87,990
Aluminum, value	$946,392	.....	Exp. $946,392
Aluminum, 1910	574,144	.....	Exp. 574,144
Ores, etc.			
Zinc oxide, lb.	21,176,252	.....	Exp. 21,176,252
Zinc oxide, '10	19,978,403	.....	Exp. 19,978,403
Zinc dross, lb.	7,170,515	.....	Exp. 7,170,515
Zinc dross, '10	7,750,239	.....	Exp. 7,750,239
Zinc ores, lg. tons	14,805	38,848	Imp. 24,043
Zinc ores, 1910	13,528	52,178	Imp. 38,650
Chrome ore, tons	5	28,386	Imp. 28,381
Chrome ore, '10	30	32,250	Imp. 32,220

Copper, lead, nickel and antimony include the metal contents of ores, matte, bullion, etc. Quantity of antimony ore is not reported. Imports of aluminum for July, August and September, 1911, were 1,304,386 lb.; not reported previous to July 1, 1911. The metal exports given above include reëxports of foreign material. Zinc contents of ore imported were 37,805,159 lb. in 1910, and 26,279,745 lb. in 1911. There were reëxported foreign ores containing 7,186,028 lb. metal in 1910, and 10,396,236 lb. this year; leaving net imports of zinc in ore 30,619;131 lb. in 1910, and 15,883,509 lb. this year.

Zinc and Lead Ore Markets

Joplin, Mo., Nov. 4—The highest price of zinc sulphide ore was $48 per ton, the base for 60 per cent. zinc ranging from $42 to $45 in the open market; the contract base price was $46.77. Zinc silicate sold on a base of $22 to $25 per ton of 40 per cent. zinc. The average price, all grades of zinc, was $42.56. The highest price paid for lead ore was unchanged at $57.50, the average price, all grades of lead, was $55.72 per ton.

The buying of several bins of reserve ore was the prime feature of the past two weeks, thus disposing of an accumulation that has blocked the natural advance of metal prices.

SHIPMENTS, WEEK ENDED NOV. 4

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	4,043,160	.....	1,357,790	$126,967
Joplin	1,878,570	.....	229,260	48,695
Galena	660,180	.....	161 960	18,975
Alba-Neck	773.910	.....	15,800	18,225
Carl Junction	656,940	.....	.....	15,765
Oronogo	440,950	.....	66,130	9,627
Duenweg	239,320	127,580	28,810	7,736
Miami	180,120	.....	168.680	7,690
Cave Springs	319,730	.....	.....	7,355
Spurgeon	139,830	126,510	43,550	6,165
Granby	7,900	412,800	23,640	6,050
Lawton	118,860	.....	.....	2,615
Saginaw	.....	66,000	52,910	2,445
Aurora	68,160	66,000	.....	2,420
Jackson	129,250	.....	.....	1,840
Sarcoxie	61,370	.....	.....	1,288
Quapaw	61,920	.....	.....	1,240
Badger	33,320	.....	9,210	950
Totals	9,813,490	798,890	2,157,640	$286,048
44 weeks	420,713,260	30,709,840	75,641,580	$11,078,816

Blende val., the week, $215,033; 44 weeks, $8,453,987
Calamine, the week, 10,894; 44 weeks, 475,904
Lead value, the week, 60,121; 44 weeks, $2,148,925

MONTHLY AVERAGE PRICES

Month	Zinc Ore Base Price		Zinc Ore All Ores		Lead Ore All Ores	
	1910	1911	1910	1911	1910	1911
January	$47.31	$41.85	$45.16	$40.55	$56.99	$55.68
February	40.69	40.21	39.47	39.16	53.64	54.46
March	43.60	39.85	39.71	38.45	51.26	54.57
April	41.00	38.88	39.33	37.47	49.72	56.37
May	40.19	38.25	37.51	36.79	48.16	55.21
June	40.20	40.50	37.83	38.18	48.80	56.49
July	39.63	40.75	36.80	38.36	48.59	58.81
August	40.13	42 50	37.32	41 28	49.75	60.74
September	43.45	42.63	39.96	41 29	54.73	59.33
October	43.31	42.38	40.50	40.89	53.18	54.72
November	47.20	.....	43.20	.....	54.80	.....
December	42.50	.....	40.70	.....	55.70	.....
Year	$42.43	.....	$39.79	.....	$52.12	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Platteville, Wis., Nov. 4—The base price paid for 60 per cent. zinc ore was $44. The base price paid for 80 per cent. lead ore was $51@52 per ton.

SHIPMENTS, WEEK ENDED NOV. 4

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	1,393,650	50,340	45,920
Mineral Point	855,060	.....	.....
Benton	484,000	.....	260,400
Highland	380,560	.....	.....
Hazel Green	298,940	.....	.....
Galena	160,900	.....	.....
Rewey	65,000	.....	.....
Linden	.....	68,220	.....
Shullsburg	.....	63,900	.....
Total	3,638,110	182,460	306,320
Year to date	129,667,319	7,980,835	25,233,770

Shipped during the week to separating plants, 1,273,120 lb. of zinc ore.

New Caledonia Ores

Exports of ores from New Caledonia for the eight months ended Aug. 31 are reported by the *Bulletin du Commerce*, of Noumea, at 66,204 metric tons of nickel ore and 26,241 tons chrome ore. Exports of metals included 283 tons copper matte and 514 tons of nickel matte.

CHEMICALS

New York, Nov. 8—The New Mineral Fertilizer Company has been incorporated at Rumford Falls, Me., with $1,000,000 capital, to develop mineral deposits and manufacture fertilizers and other products. J. A. Mennamin is president.

Potash Salts—Several discoveries of potash have been reported, in Maryland and elsewhere. According to the Geological Survey, however, most of these deposits are feldspar, carrying potash, but in an insoluble form, not suitable for fertilizer manufacture.

Copper Sulphate—Business is steady and prices unchanged at $4.50 per 100 lb. for carload lots and $4.75 per 100 lb. for smaller parcels.

Arsenic—This article continues in demand and prices are steadily advancing. For spot lots of white arsenic $2.25@ 2.37½ per 100 lb. is quoted.

Nitrate of Soda—Business is good at last prices, which are 2.25c. per lb. for spot, and 2.22½@2.25c. per lb. for futures.

Messrs. Mortimer & Wisner, New York, report the position of nitrate in the United States on Nov. 1 as follows, in long tons:

	1910	1911	Changes
Stocks, Jan. 1	14,000	12,790	D. 1,210
Imports, 10 mos	377,285	419,372	I. 42,087
Total supplies	391,285	432,162	I. 40,877
Deliveries, 10 mos	369,215	415,862	I. 46,647
Stocks, Nov. 1	22,070	16,300	D. 5,770
Afloat for U. S.	100,000	90,000	D. 10,000

Quantities afloat include all cargoes due to arrive at United States ports by Jan. 15 next.

Sulphur—The Treasury Department has decided that contrary to the decision of the Department of July 25, 1911 (T. D. 31775)—that sulphur mined in Hokkaido and exported from Hakodate, Japan, should be assesed with duty as sulphur refined at the rate of $4 per ton under paragraph 81 of the tariff act—and in view of further facts which have been presented to the Department since the ruling was promulgated, it is satisfied that this sulphur, which is roasted in furnaces after being taken from the mines and contains from 90 to 97 per cent. of pure sulphur, is not refined within the meaning of said paragraph 81. T. D. 31775 is accordingly revoked, and collectors are directed to admit the sulphur referred to free of duty under paragraph 686 of the tariff act. The revocation of the Department's ruling embodied in T. D. 31775 should not be construed to apply to the so called Bungo sulphur, which, in the opinion of the Department, is dutiable as refined sulphur under paragraph 81 at the rate of $4 per ton.

Petroleum

According to the report of the Oil City *Derrick*, the number of new wells completed in October was: New York, Pennsylvania and West Virginia, 413; Lima field, 44; Indiana, 6; Kentucky, 13; Illinois, 107; total, 583 wells.

There were 78 new wells completed in the California fields in September.

California production for the nine months ended Sept. 30 was 61,804,322 bbl., an increase of 3,585,710 bbl. over 1910. Deliveries were 52,934,686 bbl., an increase of 4,151,757 bbl. over last year.

MINING·STOCKS $

New York, Nov. 8—The general stock market has been steadier, with small advances and a rather firmer tone. Business has been on a fair scale, and the close is rather strong.

On the Curb mining stocks have been more active and sales have been good, generally at small advances. Copper stocks were in good demand and were freely dealt in. The market for Cobalt stocks was broader, and prices firm. Porcupine stocks were also bought to some extent.

There was one sale of Homestake during the week, at $85 per share.

Boston, Nov. 7—Strength and activity are developing almost daily in the copper-share market. Prices of leading copper shares have gone up from $2 to $6 per share during the week and sentiment is more hopeful than it has been for a long period.

The active issues have been North Butte and Lake Copper, although some of lesser importance have moved up materially also.

Wolverine shares were an exception to the general strength, the price of them smashing from $85 to $74, with subsequent recovery to $81. This break is believed to forecast another reduction in the dividend rate. This had no effect on other copper shares.

COPPER PRODUCTION REPORTS.

Copper contents of blister copper, in pounds.

Company	August	Sept.	October
Alaska shipments	2,095,690	.....	.....
Anaconda	22,500,000	21,565,800	21,400,000
Arizona, Ltd.	2,720,000	2,544,000	.....
Balaklala	.....	.....	.....
Copper Queen	7,006,097	6,546,540	7,786,218
Calumet & Ariz.	4,650,000	4,198,000	4,784,000
Detroit	2,080,100	1,864,050	2,086,624
East Butte	854,000	1,134,000	920,000
Mammoth	.....	.....	.....
Nevada Con.	5,249,515	5,328,983	.....
Old Dominion	1,982,000	2,032,000	.....
Shannon	1,442,560	1,550,080	1,124,000
South Utah	269,546	.....	.....
United Verde*	2,500,000	2,750,000	.....
Utah Copper Co.	9,010,669	9,285,381	.....
Lake Superior*	19,000,000	18,500,000	.....
Non-rep. mines*	.....	.....	.....
Total production	.....	.....	.....
Imports, bars, etc.	22,798,151	26,679,736	.....
Total blister	.....	.....	.....
Imp. in ore & matte	9,821,942	6,408,799	.....
Total	.....	.....	.....
Brit. Col. Cos.:			
British Col. Copper	736,515	875,023	.....
Granby	.....	.....	.....
Mexican Cos.:			
Boleo	2,149,028	2,094,400	.....
Cananea	.....	.....	5,804,000
Moctezuma	2,263,707	2,112,683	1,719,643
Other Foreign:			
Cape Cop., S. Africa	.....	.....	.....
Spassky, Russia	649,600	759,360	.....
Exports from:			
Chile	4,032,000	.....	.....
Australia	7,392,000	.....	.....

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.
*Estimated.

STATISTICS OF COPPER

Month.	United States Product'n.	Deliveries, Domestic.	Deliveries for Export
X, 1910	126,469,284	67,814,172	68,186,912
XI	119,353,463	60,801,992	67,424,316
XII	123,339,219	43,594,018	88,104,075
Year 1910	1,452,122,120	749,426,542	722,431,494
I, 1911	115,696,591	42,078,567	53,208,739
II	109,828,297	50,518,998	45,111,019
III	130,532,080	66,080,789	59,081,127
IV	118,085,223	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,936,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349

VISIBLE STOCKS.

	United States.	Europe.	Total.
XI, 1910	139,261,914	198,060,800	337,322,711
XII	130,389,069	193,200,000	323,589,095
I, 1911	122,030,195	236,629,120	358,649,373
II	142,439,490	236,992,000	379,431,134
III	156,637,770	233,385,600	390,023,009
IV	162,007,934	223,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. From Jan. 1, 1911, stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

The Curb market has been irregular with reactions in the Porcupine issues. Amalgamated Nevada broke from 11 to 3c., while considerable pressure has been put on Calaveras.

Assessments

Company	Delinq	Sale	Amt
Andes, Nev.	Nov. 2	Nov. 28	$0.05
Cedar Talisman, Utah	Nov. 9	Nov. 28	0.005
Challenge, Nev.	Nov. 21	Dec. 12	0.05
Copper Mountain, Ida.	Nov. 1	Dec. 1	0.002
Gould & Curry, Nev.	Oct. 23	Nov. 15	0.05
Hider-Nevada, Nev.	Nov. 4	Nov. 25	0.001½
Highland, Utah	Oct. 25	Nov. 25	0.01
Kinsley Development, Utah	Nov. 20	Dec. 11	0.002
Montana-Bingham, Utah	Oct. 20	Nov. 10	0.01
Mountain Dell, Utah	Oct. 24	Nov. 14	0.01
New York-Bonanza, Utah	Nov. 7	Nov. 28	0.02
Pioche Metals, Utah	Nov. 20	Dec. 11	0.005
Rainbow, Utah	Dec. 1	Dec. 20	0.002½
San Antonia, Mex.	Nov. 20		0.50
Savage, Nev.	Nov. 23	Dec. 14	0.10
Seg. Belcher, Nev.	Nov. 2	Nov. 27	0.05
Seven Troughs, Nev.	Oct. 20	Nov. 20	0.002
Sheridan, Ida.	Oct. 20	Nov. 20	0.001
Sierra Nevada, Nev.	Oct. 28	Nov. 21	0.10
Springville, Ida.	Oct. 20	Nov. 20	0.002
Superior & Boston, Ariz.	Oct. 16		0.50
Swansea, Utah	Nov. 13		0.01
Torino, Ida.	Oct. 27	Nov. 27	0.001
Union Con., Nev.	Nov. 27	Dec. 19	0.15
Utah Con. M. & M., Utah	Dec. 20		0.002½
Victoria, Mich.	Aug. 21		1.00
Winona, Mich.	Nov. 10		1.00
Wonderful, Ida.	Oct. 30	Nov. 18	0.002

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1909.	1910.	1911.	1909.	1910.	1911.
January	51.750	52.375	53.795	23.843	24.154	24.865
February	51.472	51.534	52.222	23.706	23.794	24.081
March	50.468	51.454	52.745	23.227	23.690	24.324
April	51.428	53.221	53.325	23.708	24.483	24.595
May	52.905	53.870	53.308	24.343	24.797	24.583
June	52.538	53.462	53.043	24.166	24.651	24.486
July	51.043	54.150	52.630	23.519	25.034	24.286
August	51.125	52.912	52.171	23.588	24.428	24.082
September	51.440	53.295	52.440	23.743	24.567	24.209
October	50.923	55.490	53.340	23.502	25.596	24.594
November	50.703	55.635		23.351	25.680	
December	52.226	54.428		24.030	25.160	
Total	51.502	53.486		23.706	24.670	

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1910.	1911.	1910.	1911.	1910.	1911.
January	13.620	12.295	13.870	12.680	60.923	55.604
February	13.332	12.256	13.719	12.611	59.388	54.970
March	13.255	12.139	13.586	12.447	59.214	54.704
April	12.733	12.019	13.091	12.275	57.238	54.035
May	12.550	11.989	12.885	12.214	56.313	54.313
June	12.404	12.385	12.798	12.611	55.310	56.368
July	12.215	12.463	12.570	12.720	54.194	56.670
August	12.490	12.405	12.715	12.634	55.733	56.264
September	12.379	12.201	12.668	12.508	55.207	55.253
October	12.553	12.189	12.788	12.370	56.722	55.176
November	12.742		12.914		57.634	
December	12.581		12.863		56.769	
Year	12.738		13.039		57.054	

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1910.	1911.	Month	1910.	1911.
January	32.700	41.255	July	32.695	42.400
February	32.920	41.614	August	33.972	43.319
March	32.403	40.157	September	34.982	39.755
April	32.976	42.185	October	36.190	41.185
May	33.125	43.115	November	36.547	
June	32.769	44.606	December	38.199	
			Av. Year	34.123	

Prices are in cents per pound.

LEAD

Mohth	New York		St. Louis		London	
	1910.	1911	1910.	1911.	1910.	1911.
January	4.700	4.483	4.582	4.334	13.650	13.009
February	4.613	4.440	4.445	4.266	13.328	13.043
March	4.459	4.394	4.307	4.238	13.063	13.122
April	4.376	4.412	4.225	4.262	12.641	12.889
May	4.315	4.373	4.164	4.223	12.550	12.984
June	4.343	4.435	4.207	4.292	12.688	13.260
July	4.404	4.499	4.291	4.397	12.531	13.530
August	4.400	4.500	4.290	4.406	12.513	14.026
September	4.400	4.485	4.289	4.356	12.582	14.744
October	4.400	4.265	4.271	4.139	13.091	15.332
November	4.442		4.314		13.217	
December	4.500		4.363		13.197	
Year	4.446		4.312		12.920	

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1910.	1911.	1910.	1911.	1910.	1911.
January	6.101	5.452	5.951	5.302	23.350	23.887
February	5.569	5.518	5.419	5.368	23.188	23.276
March	5.637	5.563	5.487	5.413	23.031	23.016
April	5.439	5.399	5.289	5.249	22.469	23.743
May	5.191	5.348	5.041	5.198	22.100	24.375
June	5.128	5.520	4.978	5.370	22.094	24.612
July	5.152	5.695	5.002	5.545	22.406	25.006
August	5.279	5.953	5.129	5.803	22.800	26.801
September	5.514	5.869	5.364	5.719	23.165	27.750
October	5.628	6.102	5.478	5.951	23.900	27.256
November	5.976		5.826		24.083	
December	5.624		5.474		24.019	
Year	5.520		5.370		23.050	

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1910	1911	1910	1911	1910	1911
January	$19.90	$15.90	$17.96	$14.40	$17.94	$14.75
February	18.96	15.90	17.21	14.50	17.38	14.81
March	18.53	15.90	16.93	14.65	17.00	14.96
April	18.28	15.90	16.84	14.65	16.75	15.00
May	17.10	15.90	15.94	14.30	16.18	14.72
June	16.52	15.90	15.60	14.06	15.53	14.56
July	16.40	15.90	15.40	14.03	15.40	14.53
August	16.09	15.90	14.89	14.00	15.16	14.47
September	15.92	15.90	14.73	13.57	14.93	14.40
October	15.90	15.43	14.05	13.44	14.88	14.34
November	15.84		14.26		14.78	
December	15.90		14.15		14.65	
Year	$17.10		$15.65		$15.83	

STOCK QUOTATIONS

COLO. SPRINGS Nov. 6

Name of Comp.	Bid.
Acacia	.03⅜
Cripple Cr'k Con.	.02½
C. K. & N.	‡.10
Doctor Jack Pot	.05
Elkton Con.	.62
El Paso	.50
Findlay	.05
Gold Dollar	.13⅞
Gold Sovereign	.02
Isabella	.09
Jack Pot	.05
Jennie Sample	.05⅜
Lexington	‡.01
Moon Anchor	.01½
Old Gold	.03⅜
Mary McKinney	.43
Pharmacist	.01
Portland	.88¾
Vindicator	.65
Work	.02½

SALT LAKE Nov. 6

Name of Comp.	Bid.
Beck Tunnel	.17
Black Jack	.09¾
Carisa	.16
Cedar Talisman	.02½
Colorado Mining	.27
Columbus Con	.28½
Daly Judge	‡4.12½
Grand Central	.93
Iron Blossom	.97
Little Bell	‡.35
Lower Mammoth	.02½
Mason Valley	8.20
May Day	.11
Nevada Hills	2.65
New York	‡.05⅜
Prince Con	.85
Silver King Coal'n	‡1.80
Sioux Con.	.11½
Uncle Sam	.27
Yankee	‡.13

TORONTO Nov. 7

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	6.20	Pearl Lake	.44½
Hudson Bay	70.00	Porcu. Gold	.48¾
Temiskaming	.39½	Porcu. Tisdale	.06
Wettlaufer-Lor.	.81	Preston E. D.	.23
Apex	.13	West Dome	.98
Central	3.50	Standard	.13
Dobie	1.05	Foley O'Brien	.70
Dome Exten.	.76½	Rea	2.98
Hollinger	10.80	Coronation	.03
Imperial	.10	Swastika	.32½

SAN FRANCISCO Nov. 6

Name of Comp.	Clg.
COMSTOCK STOCKS	
Alta	.04
Belcher	.60
Best & Belcher	.14
Caledonia	1.07½
Challenge Con.	.17
Chollar	.10
Confidence	.53
Con. Virginia	.77
Crown Point	.87
Gould & Curry	.11
Hale & Norcross	.16
Mexican	3.35
Occidental	.50
Ophir	1.82½
Overman	.98
Potosi	.20
Savage	.14
Sierra Nevada	.43
Union Con.	1.32½
Yellow Jacket	.45

Name of Comp.	Bid
MISC. NEV. & CAL.	
Belmont	8.25
Jim Butler	.22
MacNamara	.25
Midway	.24
Mont.-Tonopah	.43
North Star	.33
West End Con.	.87
Atlanta	.16
Booth	.06
C.O.D. Con.	.14
Comb. Frac.	.08
Jumbo Extension	.20
Pitts.-Silver Peak	.95
Silver Pick	.07
St. Ives	.35
Tramps Con.	.02
Argonaut	‡2.50
Bunker Hill	‡6.50
Cent. Eureka	.44
So. Eureka	‡6.00

N. Y. EXCH. Nov. 6

Name of Comp.	Clg.
Amalgamated	55⅛
Am. Agri. Chem.	51
Am.Sm.&Ref.,com	69¼
Am. Sm.& Ref., pf.	102
Anaconda	‡33⅛
Batopilas Min.	‡1⅞
BethlehemSteelpf	58⅛
Chino	21⅞
Comstock Tunnel	‡.19
Federal M.& S., pf.	52
Goldfield Con.	4⅛
Great Nor., ore ctf.	41¾
Homestake	85
Miami Copper	19⅛
Nat'nalLead,com.	49
National Lead, pf.	‡106
Nev. Consol	16⅜
Pittsburg Coal, pf.	81½
Ray Con.	14¼
RepublicI&S,com	21⅛
Republic I & S, pf.	80
SlossSheffi'd,com.	41
Sloss Sheffield, pf.	‡110¼
Tennessee Copper	36⅜
Utah Copper	46
U. S. Steel, com.	60¼
U. S. Steel, pf.	108⅜
Va. Car. Chem.	48⅜

BOSTON EXCH. Nov. 6

Name of Comp.	Clg.
Adventure	4¾
Algomah	3⅜
Allouez	29
Am. Zinc	23½
Arcadian	2
Arizona Com.	.40
Atlantic	‡6
Bonanza	.37
Boston & Corbin	.05
Butte & Balak	4
Calumet & Ariz.	50
Calumet & Hecla	390
Centennial	9⅞
Con. Mercur	.03
Copper Range	52¾
Daly-West	5½
East Butte	10¼
Franklin	7¾
Granby	30
Hancock	20
Hedley Gold	‡14½
Helvetia	75
Indiana	7¾
Isle Royale	14¾
Keweenaw	1⅞
Lake	30⅛
La Salle	4¾
Live Oak	22½
Mass	5¾
Michigan	1¼
Mohawk	42½
New Arcadian	2¾
North Butte	25⅞
North Lake	4¾
Ojibway	7
Old Dominion	42
Osceola	90
Parrot	9¾
Quincy	58
Shannon	7⅝
Shattuck-Ariz.	16½
Superior	23
Superior & Bost.	3¾
Tamarack	26
Trinity	3
Tuolumne	3½
U. S. Smelting	32
U. S. Smelt'g, pf.	46¼
Utah Apex	2¾
Utah Con.	15¾
Victoria	3
Winona	4
Wolverine	80
Wyandot	75

N. Y. CURB Nov. 6

Name of Comp.	Clg.
Barnes King	.30
Beaver Con.	.46
Braden Copper	5
B. C. Copper	4
Buffalo Mines	‡1.40
Butte & Vipond	.53
Butte Coalition	17⅜
Cobalt Central	.01
Con. Ariz Sm.	1/16
Davis-Daly	1
Ely Con.	3/16
Florence	.76
Giroux	4 7/16
Gold Hill Con.	3/16
Greene Cananea	7⅛
Greenwater	05
Guanajuato	‡3¾
Guerrero	‡1¼
Guggen. Exp.	170
Inspiration	8¼
Internat. S. & R.	‡124
Kerr Lake	3 3/16
La Rose	3 5/16
McKinley-Dar-Sa.	1⅞
Min. Co. of A. new	4
Nev. Utah M. & S.	⅛
Nipissing Mines	7⅝
Ohio Copper	1¼
Pacific Sm. & M.	⅛
Precious Metals	‡1⅜
Ray Central	2¼
Red Warrior	‡1½
South Utah M. & S.	¾
Standard Oil (Old)	625
Stand'd Oil of N.J.	340
Stand'd Oil Subs.	325
Stewart	.82
Tonopah	7
Tonopah Ex.	1¼
Tri-Bullion	1/16
Tularosa	‡⅜
Union Mines	¼
Yukon Gold	‡3⅝

BOSTON CURB Nov. 6

Name of Comp.	Last
Ahmeek	180
Bingham Mines	1
Boston Ely	84
Boswyocolo	10½
Cactus	.23
Calaveras	75
United Verde Ext.	.80
Chief Cons	.60
Corbin	1 3/16
Cortez	1½
Crown Reserve	2½
First Nat. Cop.	1
Majestic	.32
Mazatan	‡.40
Moneta Porc.	‡.12
Nat'l Mine & Ex.	.07
Nevada-Douglas	2½
New Baltic	4½
Oneco	1½
Raven Copper	23
Rhode Island Coal	1½
San Antonio	‡3½
South Lake	4
Trethewey	‡.65
United Zinc, pfd.	‡2
Vulture	5
Yuma	‡.02

LONDON Nov. 8

Name of Com.	Clg.
Camp Bird	£1 11s 6d
Dolores	1 10 0
El Oro	1 3 0
Esperanza	1 13 1½
Mexico Mines	7 17 6
Oroville	0 3 6
Stratton'sInd.	0 2 0
Tomboy	1 3 0

‡Last quotation.